Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M. TECH (ENVIRONMENTAL ENGINEERING) END SEMESTER EXAMINATIONS - 2021

SUBJECT: ADVANCED WATER AND WASTEWATER TREATMENT (CIE-5181)

Date of Exam: 22-02-2021 Time of Exam: 2:00 – 5:00 pm Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed.

A.	List and explain the various levels of wastewater treatment and pollutants that are removed in each level.	**5**	**CO2**
1B.	Design a screen chamber to treat a peak flow of 80 MLD of sewage. Assume the inclination as 45 degree with the horizontal, size of the bar 10 mm* 70 mm with 50 mm clear spacing and the velocity through the screens is 0.8 m/s at peak flow.	**5**	**CO2**
2A.	What do you understand by digestion of sewage sludge? With a neat diagram explain the anaerobic sludge digestion process.	**4**	**CO5**
2B.	Write the typical composition of domestic wastewater and discuss its typical analysis at various points in its course.	**4**	**CO5**
2C.	Discuss the impact of suspended solids and nutrients on the receiving water bodies.	**2**	**CO4**
3A.	BOD of a sewage incubated for one day at 30 °C has been found to be 100 mg/L. What will be the 5-day BOD at 20 °C? Assume k = 0.12 (base 10) at 20 °C and $\theta = 1.056$	**4**	**CO2**
3B.	What is re-oxygenation? What are the factors that affect re-oxygenation?	**3**	**CO2**
3C.	An average operating data for conventional activated sludge treatment plant is as follows: Wastewater flow = 35000 m^3/day Volume of aeration tank = 10900 m^3 Influent BOD = 250 mg/l Effluent BOD = 20 mg/l Mixed liquor suspended solids (MLSS) = 2500 mg/L Effluent suspended solids = 30 mg/l Waste sludge suspended solids = 9700 mg/l Quality of waste sludge = 220 m^3/d Based on the information above, determine: i) Aeration period (hours) ii) Food to micro-organisms ratio (F/M) (kg BOD per day/kg MLSS) iii) Percentage efficiency of BOD removal iv) Sludge age	**3**	**CO4**
4A.	Design a circular sedimentation tank with all its components for primary treatment of sewage for a town having a population of 6 lakh with water supply rate of 140 LPCD. Assume surface loading rate of 50 m^3/m^2-d at peak flow and DT = 2 hrs	**5**	**CO4**

4B.	Discuss in detail two most common difficulties encountered in the operation of activated sludge plant. Elaborate the problem and solution to overcome the problem.	**5**	**CO5**
5A.	With a schematic diagram discuss the process description of trickling filter including media bed, containment structure, wastewater dosing system, under-drain system and the ventilation system.	**5**	**CO4**
5B.	A municipal wastewater treatment plant discharges secondary effluent to a surface stream. During summer, when the stream flow is low and water temperature is high, measurements are made. The wastewater is found to have a maximum flow of 12000 m^3/d, BOD_5 of 35 mg/L, DO of 3 mg/L and the temperature of 25 C. The stream found to have a minimum flow of 0.6 m^3/s, BOD_5 of 4 mg/L, DO of 10 mg/L and a temperature of 23°C. The mixing of wastewater and stream is instantaneous. The velocity of mixture is 0.4 m/s. The reaeration constant is estimated to be 0.5 d^{-1} for 20°C. Assume $k_d = 0.23$. Find the critical deficit of the mixture and the Minimum Dissolve Oxygen. Assume saturation DO as 90% of Dissolved Oxygen of the stream.	**5**	**CO4**