Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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I SEMESTER M. TECH (ENVIRONMENTAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: Advanced Water and Wastewater Engineering - CIE 5121

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL FIVE FULL** questions.
- Missing data may be suitably assumed.

1A.	Discuss the objectives of biological treatment of wastewater. Explain the unit operation and unit process.	**5**
1B.	Explain the use of 'mass balancing concepts' for proactively solving rural water supplies having concern with problem parameters like: Fluoride and Arsenic. Provide quality limits.	**5**
2A.	Many rivers in India are severely polluted due to the multiple sources of contaminants being released into them. Major sources of pollutants are point discharges of municipal and industrial wastewaters and non-point discharges of surface runoff. a. The following data were obtained from regular monitoring of one river: average annual flow 1 m^3/s additionally, wastewater discharges constituted 80% of the annual average flow in the river. The wastewater discharge standards for heavy metals like Hg and Cd are 0.01 and 2 mg/L for discharge to inland rivers (CPCB). Calculate the pollutant load to the river during one year if the wastewater is treated to the permissible level. b. Nutrients like nitrates and phosphates result in further degradation of river water quality. The average nitrate concentration in the wastewater discharges was 5.0 mg/L and that of phosphate was 1.0 mg/L. Determine the mass loading of nutrients in the river on daily and yearly basis.	**4**
2B.	Briefly describe the process of trickling filter with a schematic representation.	**3**
2C.	When do you need equalization unit in wastewater treatment? Explain briefly off-line equalization as applied to wastewater treatment.	**3**
3A.	Derive an expression for finding critical DO deficit of a natural stream.	**5**
3B.	A city discharges 20000 m^3/day of sewage into a river whose rate of flow is 0.7 m^3/sec. Determine D.O. deficit profile for next 4 reaches with 20 km interval from beginning with following data:	**5**

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	Parameter / River / Sewage effluent from STP BOD_5 at 20°C (mgL^{-1}) / 3.4 / 45 Temperature (°C) / 23 / 26 DO (mgL^{-1}) / 8.2 / 2.0 Velocity of mix = 0.25 ms^{-1}, k_r=0.4, k_d= 0.23	
4A.	Design a complete mix activated sludge process to treat 0.25 m^3/s of wastewater with BOD_5 of 250 mg/L. The effluent is to have BOD_5 of 20mg/L or less. Assume the temperature is 20°C and the following conditions are applicable. • The influent and effluent microorganism concentrations are negligible. Food and microorganisms are completely mixed in the aeration basin. Wastewater contains adequate nitrogen, phosphorus and other trace nutrients for biological growth. • Ratio of MLVSS to MLSS is 0.8. (MLSS and MLVSS: Mixed liquor suspended solids (represents total solids) and mixed liquor volatile suspended solids (represents biological solids). • MLVSS concentration in the reactor = 3500 mg/L; Return sludge concentration = 10,000 mg/L • Design mean cell residence time (θ_C) is 10 days • Effluent contains 22 mg/L of bio solids, of which 65% is biodegradable • Kinetic coefficients: K_s = 50 mg/L; μ_m = 5.0 d^{-1}; k_d = 0.06 d^{-1} and Y = 0.50.	**5**
4B.	Differentiate the sludge bulking problem from the raising sludge problem? State the measures that can be taken to avoid the raising sludge problem?	**3**
4C.	Write a note on sequencing batch reactor.	**2**
5A.	With a flow chart and chemical equations, explain briefly the nitrification and de-nitrification process	**5**
5B.	Write a short note on the following: a. Sludge digestion process b. Continuous and plug flow reactor system in wastewater treatment	**5**