Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VII SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: INDUSTRIAL WASTEWATER ENGINEERING [CHE 427]

REVISED CREDIT SYSTEM
(02/12/2016)

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY 5 FULL** questions.
- Missing data may be suitably assumed.

1A.	Discuss the classification of total solids in waste water coming from a fertilizer plant	(8 marks)
1B.	Discuss the advantages of employing a grit removal chamber in an effluent treatment plant	(4 marks)
1C.	Calculate the scour velocity in a primary sedimentation tank for solids with average particle diameter 110 µm, specific gravity 1.3, cohesion constant 0.05 and Darcy friction factor 0.02. Comment on the results if the horizontal velocity is 1 ms^{-1}	(8 marks)
2A.	A certain industry discharges 18000 m^3/d of treated waste water into a nearby river. The treated waste water has a BOD_5 of 14 mg/l and k = 0.11 d^{-1} at 20°C. The river has a flow rate of 0.5 m^3/s and an ultimate BOD of 5.5 mg/l. The dissolved oxygen of the river is 6.5 mg/l and dissolved oxygen of wastewater is 1 mg/l. Compute dissolved oxygen and initial uBOD after mixing.	(10 marks)
2B.	Write a note on the chemical precipitation of phosphorus and heavy metals from industrial effluent	(10 marks)
3A.	Determine the size of high rate trickling filter for the following data: Flow rate = 4.5 MLD, Recirculation ratio = 1.5 BOD_5 of raw effluent = 250 mg/l BOD removal in PST = 30% Find effluent BOD desired	(8 marks)
3B.	Describe any two types of high rate anaerobic reactors with a neat flow diagram?	(6 marks)
3C.	Explain the different modifications of ASP with a neat flow diagram	(6 marks)
4A.	Prepare preliminary designs for a rotary disc type installation to serve 1000 persons. Assume 80% BOD removal at an organic load of 20 g BOD_5/m^3.day and	(8 marks)

<table>
<tr><td></td><td>3m diameter discs spaced 5 cm apart on centre. At 54 g of BOD/person.day and 200 lpcd, Flow Q is 200 m^3/day.</td><td></td></tr>
<tr><td>4B.</td><td>A conventional activated sludge process plant is in operation with a θ_c of 10 days. Reactor volume = 8000 m^3, MLSS = 3000 mg/l.
Determine
(i)Sludge production rate
(ii)Sludge wastage flow rate when wasting from the reactor
(iii)Sludge wastage flow rate when wasting from the recycle line.
Assume concentration of suspended solids in the recycle line as 10000 mg/l.</td><td>(6 marks)</td></tr>
<tr><td>4C.</td><td>A mechanically aerated lagoon provides 5 days detention time to a wastewater flow of 10000 m^3/day. If its depth is restricted to 3 m, estimate the lagoon dimensions so that the dispersion number D/uL will be 0.5 or less.</td><td>(6 marks)</td></tr>
<tr><td>5A.</td><td>Determine the liquid volume before and after digestion and the percentage reduction for 300 kg on dry basis of primary sludge with the following characteristics:
<table>
<tr><td></td><td>Primary sludge</td><td>Secondary/Digested sludge</td></tr>
<tr><td>% of solids</td><td>5</td><td>10</td></tr>
<tr><td>Volatile matter (%)</td><td>50</td><td>60</td></tr>
<tr><td>Specific gravity of fixed solids</td><td>2.5</td><td>2.5</td></tr>
<tr><td>Specific gravity of volatile solids</td><td>1.0</td><td>1.0</td></tr>
</table></td><td>(7 marks)</td></tr>
<tr><td>5B.</td><td>Distinguish between
(a) Suspended- and attached- growth processes
(b) Aerobic and anaerobic processes
(c) Nitrification and denitrification
(d) Extended aeration and Conventional ASP process</td><td>(8 marks)</td></tr>
<tr><td>5C.</td><td>What do you mean by sloughing and what are the advantages and disadvantages of trickling filter?</td><td>(5 marks)</td></tr>
<tr><td>6A.</td><td>Discuss the advantages of Dissolved/Dispersed Air Flotation over a conventional primary sedimentation tank.</td><td>(8 marks)</td></tr>
<tr><td>6B.</td><td>Classify and briefly explain the various high rate clarification processes employed in industrial waste water treatment</td><td>(6 marks)</td></tr>
<tr><td>6C.</td><td>Explain the importance of Aeration in an effluent treatment plant</td><td>(6 marks)</td></tr>
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