Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent institution of MAHE, Manipal)

VI SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, APRIL/MAY 2018

SUBJECT: WASTE WATER MANAGEMENT [CIE 3202]

REVISED CREDIT SYSTEM

(20/ 04/ 2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer ALL the questions.
- Missing data may be suitable assumed.

Q.No		Marks	CO
1A.	List and discuss the objectives of biological treatment of wastewater. Explain the unit operation and unit process in detail	**5**	**CO1**
1B.	Wastewater sample is being analyzed to determine its BOD content. The sample is diluted to perform the test: 295 mL of distilled water are added to 5 mL of sample to fill the 300 mL BOD bottle. The bottle has an initial dissolved oxygen concentration of 8.2 mg/L. After incubating 5 days, the dissolved oxygen concentration is 4.8 mg/L. i) What is the 5-day BOD of the wastewater? ii) The deoxygenation rate constant, k_d, is 0.13 day^{-1}. What is the ultimate BOD of the wastewater?	**3**	**CO2**
1C.	List any 4 advantages and disadvantages of trickling filters used in wastewater treatment	**2**	**CO2**
2A.	Design a horizontal grit chamber for population 50000 with water consumption of 1351pcd. (Note: Consider sewage generation 80% of water supply, Maximum flow is 2.5 times the average flow, assume horizontal velocity as 20 cm/sec, Detention time as one minute, 25% additional length to accommodate inlet and outlet zones).	**3**	**CO4**
2B.	Assuming suitable design philosophies, design a complete screen chamber to treat a maximum flow of 0.15 m^3/s of domestic wastewater. Approach velocity is given as 0.75 m/s. Assume dimensions of bar screen as 10mm x 50mm with spacing of 25mm. The cleaning frequency is once in 3 days and quantity of screenings produced is $0.015m^3/1000m^3$ of waste water per day	**5**	**CO4**
2C.	With a diagram briefly explain the Waste Stabilization Pond (WSP) used in wastewater treatment.	**2**	**CO3**
3A.	Explain i) Weir Loading ii) Compression settling iii) Detention period in settling tanks	**3**	**CO3**
3B.	With a neat sketch explain the working and parts of vertical flow sedimentation tank.	**3**	**CO3**

<table>
<tr><td>3C.</td><td>Determine the size of first and second stage trickling filter of a two stage trickling filter treating a sewage flow of 4MLD at a recirculation ratio of 1.2. The BOD of the incoming sewage to the first stage filter is 300mg/1 and BOD of final effluent from secondary filter is 30 mg/l. Efficiency of first stage filter is 76%. Also determine the hydraulic loading and organic loading on the first stage filter. Assume depth of trickling filters as 2m.</td><td>4</td><td>CO4</td></tr>
<tr><td>4A.</td><td>Design the activate sludge units for the following data

Population served 50000
Average sewage flow 180lpcd
BOD of raw sewage 200 mg/l
Raw sewage suspended solids 300 mg/ l
BOD removal in primary clarifier 35%
Overall BOD reduction desired 80%
F/M ratio 0.2
MLSS in aeration tank 3000 mg/ l
Air requirement 120 m^3/day per kg of BOD removed

Also check for hydraulic retention time and volumetric loading rate and calculate return sludge ratio assuming SVI as 100.</td><td>4</td><td>CO4</td></tr>
<tr><td>4B.</td><td>Mention any 3 merits and demerits of Septic tank.</td><td>3</td><td>CO3</td></tr>
<tr><td>4C.</td><td>With a neat sketch differentiate between step aeration and tapered aeration in activated sludge process.</td><td>3</td><td>CO3</td></tr>
<tr><td>5A.</td><td>With the flow diagram explain the sludge treatment process.</td><td>4</td><td>CO3</td></tr>
<tr><td>5B.</td><td>Mention and explain the zones of pollution in a stream</td><td>3</td><td>CO4</td></tr>
<tr><td>5C.</td><td>A wastewater treatment plant disposes off its effluent into a stream at a point A. Characteristics of stream at the upstream of point A and effluent are as follows
<table>
<tr><td>Item</td><td>Units</td><td>Effluent</td><td>Stream</td></tr>
<tr><td>Flow</td><td>m^3/s</td><td>0.2</td><td>0.5</td></tr>
<tr><td>Dissolved oxygen</td><td>mg/I</td><td>2.0</td><td>8.0</td></tr>
<tr><td>Temperature</td><td>°c</td><td>26</td><td>22</td></tr>
<tr><td>BOD_5 at 20°C</td><td>mg/I</td><td>40</td><td>3</td></tr>
</table>
Determine the following after mixing of effluent with the river water at point A. Take deoxygenation constant as 0.1/day and reoxygenation constant 0.3/day and saturation DO as 9.10 mg/1.
i. Combined discharge
ii. BOD
iii. DO
iv. Temperature
v. DO at the end of 2 days from the mixing</td><td></td><td>CO4</td></tr>
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