| Reg. No. | | | | | | | | | | |
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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*(A constituent unit of MAHE, Manipal)*

VI SEMESTER B.TECH (CIVIL) END SEMESTER EXAMINATIONS

APRIL/MAY 2019

SUBJECT: WASTE WATER MANAGEMENT [CIE 3202]

Date of Exam: **27/4/2019** Time of Exam: **2:00-5:00pm** Max. Marks: **50**

**Instructions to Candidates:**

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

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|---|---|---|---|
| **1A.** | Explain with a neat flow sheet ,various processes involved in sludge treatment and disposal | **5** | **CO2** |
| **1B.** | With a neat diagram explain the working of rotating biological contactor | **5** | **CO2** |
| **2A** | A grit chamber having rectangular cross section has to be designed for a 18MLD flow of sewage. The diameter of the smallest grit particles that settles is 0.2mm and the specific gravity of settling particles is 2.65. The average temperature is 20°C. Assume width of the approach channel as 1m. Determine the dimensions of grit chamber. | **4** | **CO3** |
| **2B.** | A 5-day BOD of a waste water has been found to be 500mg/L. If $K_{(base\ e)}$ = 0.23/day. What is the ultimate BOD of waste water? What proportion of BOD ultimate would remain un-oxidized after 18 days | **4** | **CO1** |
| **2C.** | Differentiate between Suspended growth system and Attached growth system | **2** | **CO2** |
| **3A.** | i. Design a high rate trickling filter for treating sewage of 15 MLD with a raw sewage $BOD_5$ of 330 mg/L. A 30% BOD is satisfied in primary treatment. Assume a recirculation ratio of 1.5, depth of filter as 1.2m and efficiency of the filter as 85%. Also calculate the effluent BOD5.<br>ii. What is the significance of recirculation of treated effluent to filter? | **5** | **CO4** |
| **3B.** | Explain in detail about the design procedure which needs to be adopted while designing screen chamber | **2** | **CO3** |
| **3C.** | What are stabilization ponds? Explain the algae – bacteria symbiosis in a stabilization pond with a neat sketch. | **3** | **CO2** |
| **4A** | A completely mixed ASP is used to treat a wastewater flow of 1 MLD having a $BOD_5$ of 200 $mgL^{-1}$. The biomass concentration in the aeration tank is 2000 $mgL^{-1}$ and the concentration of net biomass leaving the system per day is 50 $mgL^{-1}$. The aeration tank has a volume of 200 $m^3$. It has been found that the effluent solids concentration is zero.<br>i. What is the Hydraulic Retention Time of the wastewater in aeration tank in hrs?<br>ii. What is the average time for which biomass stays in the system? | **4** | **CO4** |
| **4B.** | Define the following<br>i. Hydraulic Retention Time ii. F:M Ratio<br>iii. Volumetric BOD Loading Rate iv. Sludge Age | **4** | **CO4** |
| **4C** | Briefly explain the process mechanism of ASP with flow sheet? | **2** | **CO4** |

<table>
<tr><td>5A.</td><td>With the help of a graph, explain the DO behavior at the downstream side of a river when an organic contaminant is discharged. Also discuss in detail, the different zones during self-purification process with a neat sketch.</td><td>5</td><td>CO5</td></tr>
<tr><td>5B.</td><td>The WWTP in the Manipal campus discharges 0.4375 $m^3/s$ of secondary effluent into River Swarna whose minimum flow rate is 100 $m^3/s$.
<table>
<tr><th></th><th>WWTP effluent</th><th>Stream water</th></tr>
<tr><td>Temperature (°C)</td><td>20</td><td>15</td></tr>
<tr><td>$BOD_5$ ($mgL^{-1}$) (at 20 °C)</td><td>200</td><td>1</td></tr>
<tr><td>Dissolved oxygen ($mgL^{-1}$)</td><td>2</td><td>80% of saturation level</td></tr>
<tr><td>Oxygen consumption rate ($k_d$ or K') ($day^{-1}$)</td><td colspan="2">0.3</td></tr>
<tr><td>Oxygen re-aeration rate ($k_r$ or R')($day^{-1}$)</td><td colspan="2">0.7</td></tr>
</table>
Using above information, calculate the following:<br>
1) Temperature, dissolved oxygen (DO) and BOD of the mixture.<br>
2) Initial dissolved oxygen deficit at the place of mixing.<br>
3) Critical oxygen deficit ($D_c$) and Critical time ($t_c$).<br>
(Saturated dissolved oxygen concentration in stream before discharge is 10.07 mg/L at 15°C. Use temperature coefficients, $\theta$= 1.135 for $k_d$ and $\theta$=1.024 for $k_r$ for applying temperature corrections for these two constants.</td><td>5</td><td>CO5</td></tr>
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