Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014**

**Subject code: 1721701** **Date: 16-06-2014**

**Subject Name: Principles of Wastewater Treatment**

**Time: 02:30 pm - 05:00 pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**Q.1** **(a)** What do you understand by unit operations and unit processes in wastewater treatments? Explain in brief unit operations and unit processes used in treatment of domestic wastewater. **07**

**(b)** Discuss sources and impacts of following constituents of wastewater. **(any Three)** **07**
(i) Solids (ii) Odour (iii) Nitrogen (iv) COD (iv) pH

**Q.2** **(a)** What do you understand by BOD? What is its significance in field of wastewater treatment? What are the limitations of BOD test? The 5 day 20$^o$C BOD of a wastewater is 200mg/l. what will be the ultimate BOD? What will be the 8-d demand? If the bottle had been incubated at 30$^o$C, what would the 5-d BOD had been? k=0.23d$^{-1}$. **07**

**(b)** Write note on effluent disposal to River. **07**

**OR**

**(b)** A wastewater containing 130mg/l of $BOD_5$ after preliminary treatment is discharged to a river at a rate of 75000m$^3$/d. the river has a minimum flow rate of 6m$^3$/s, a $BOD_5$ of 2mg/l, and a velocity of 2.4 km/h. after the wastewater is mixed with the river contents, the temperature is 20$^o$C and dissolved oxygen is 75 percent of saturation. Determine the oxygen sag at the critical point and at distance of $x_c/2$ above and below the critical point. Kô=0.25/d: kô$_2$=0.4/d. **07**

**Q.3** **(a)** Give objectives of screening in wastewater treatment processes. Explain in detail various types of screens used for wastewater treatment. **07**

**(b)** Design a screen chamber to treat maximum flow of 0.5 m$^3$/s of domestic wastewater. **07**

**OR**

**Q.3** **(a)** What do you understand by Flotation? What are the advantages of flotation over sedimentation in wastewater treatment? Discuss in detail various types of flotation systems. **07**

**(b)** Assuming suitable data, design a primary sedimentation tank to treat domestic wastewater flow of a town having 5,00,000 population. **07**

**Q.4** **(a)** What do you understand by activated sludge process? Enumerate various modifications of activated sludge process. Explain any one in detail. **07**

**(b)** Design an aerobic waste stabilization pond to treat 4.0 MLD flow of sewage having 200 mg/l $BOD_5$ for a desired effluent $BOD_5$ of 20 mg/l. Assume BOD removal rate constant to be 0.20 d$^{-1}$ at 20$^o$C and the pond dispersion factor as 0.5. The wastewater temperatures in summer and winter are 35$^o$C and 25$^o$C respectively. Individual pond area and depth should not be more than 3.0 hectares and 1.2m respectively. **07**

**OR**

**Q.4** **(a)** What do you understand by a ótrickling filterô? Explain with the help of a neat sketch, the biological process involved in working of a trickling filter. **07**

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| **Q.4** | **(b)** | Explain the mechanism of purification in facultative ponds. How do you determine the size and detention period for a facultative type stabilization pond? | **07** |
| **Q.5** | **(a)** | What do you understand by ódigestionô of sludge? Differentiate between anaerobic and aerobic digestion. Explain the mechanism of anaerobic digestion. | **07** |
| | **(b)** | Explain in brief various methods of final disposal of sludge. | **07** |

**OR**

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| **Q.5** | **(a)** | Discuss in brief the biological methods of removal of phosphorous from wastewater. | **07** |
| | **(b)** | Discuss in brief biological nitrification-denitrification for removal of nitrogen from wastewater. | **07** |

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