Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE – SEMESTER – VI EXAMINATION – WINTER 2015**

**Subject Code:163702** **Date:08/12/ 2015**

**Subject Name: Water & Wastewater Treatment Design**

**Time:2:30pm to 5:00pm** **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)** Give the difference between **07**
(i) High rate Trickling filter and low rate trickling filter
(ii) Aerobic and anaerobic treatment processes

**(b)** Elucidate about the different types of mixers used in water/waste water treatment process. **07**

**Q.2** **(a)** Sketch the diagram of conventional RSF and even explain all modification of RSF **07**

**(b)** What is sedimentation? Explain different types of sedimentation phenomena. **07**

**OR**

**(b)** Design a RBC system for following data **07**

1) $BOD_5$ of waste water from PST=120mg/l
2) Permissible BOD of effluent=20mg/l
3) Permissible organic loading rate=0.05kg $BOD_5$ /$m^2$/day
4) Waste water discharge=5MLD Assume the suitable data as required,

**Q.3** **(a)** Write short notes on design guideline for ASP reactor to be used in treatment of Industrial waste water **07**

**(b)** An average operating data for conventional activated sludge treatment plant is as follows **07**

1) Waste water flow =50,000$m^3$/day
2) Volume of tank=1,55,000$m^3$
3) Influent BOD=200mg/l
4) Effluent BOD=25mg/l
5) MLSS=3000mg/l
6) Effluent SS=40mg/l
7) Waste sludge SS=12000mg/l
8) Quantity of waste sludge=250$m^3$/day

Based on the information above, determine

1) Aeration period
2) F/M ratio
3) % efficiency of BOD removal
4) Sludge age(Days)

**OR**

**Q.3** **(a)** Enlist and explain the basic steps involved in the overall anaerobic oxidation of a waste water **07**

**(b)** Describe steps for design of Trickling filter **07**

**Q.4** **(a)** Design an oxidation ditch for a community with following data- **07**

i) Population of the community = 6000 per person

ii) Organic load of sewage = 40gm BOD Per Capita Per Day.

iii) Sewage flow = 160 lpcd

iv) Permissible BOD of effluent = 20mg/l

**(b)** Why sometime any existing treatment plant need up gradation and what are methods of up gradation **07**

**OR**

**Q.4** **(a)** The quantity 40 mg/L of alum is added to 40,000 $m^3$/d of raw water containing 75 mg/L of suspended solids and 152.5 mg/L of $HCO_3$ **07**
(i) Is there sufficient alkalinity in the raw water for chemical precipitation? (ii) If not, how much should be added? (iii) What is the daily consumption of alum and daily production of sludge?

**(b)** Write the prime objective of following unit **07**
(i) Flocculator (ii) Bio reactor (iii) Filtration system

**Q.5** **(a)** Draw the treatment plant only with the consideration of following **07**
(i) Alum and lime dosing tank
(ii) Both ASP and RBC are incorporated in secondary treatment
(iii) Pressure sand filter with 6 filter bed

**(b)** Determine the built up of head loss through a bar screen when 60% of the flow area is blocked off due to the accumulation of coarse solids. Assume the following conditions: **07**
(i) Approach velocity= 0.6 m/s
(ii) Velocity through clean bar screen= 0.9 m/s
(iii) Open area for flow through clean bar screen= 0.2 $m^2$
(iv) Head loss Coefficient for clean bar = 0.7

**OR**

**Q.5** **(a)** Explain the exchange reaction mechanism of dissolved solids with the cation and anion exchange resins and also explain that how they can be regenerate after the exhausted **07**

**(b)** Determine the size of a high rate trickling filter for the following data- **07**

i) Sewage flow = 5mld

ii) Recirculation Ratio = 1.5

iii) BOD of raw sewage = 230 mg/l

iv) BOD removal in Primary clarifier = 30%

v) Final effluent BOD desired = 25 mg/l

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