Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME Semester –III Examination Dec. – 2011

Subject code: 731701 Date: 08/12/2011

Subject Name: Design of Water and Waste water Systems

Time: 10.30 am – 01.00 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)** Discuss in detail variations in wastewater flows. **07**

(b) Design screen and girt chamber to cater 3mi\ld of wastewater flow. **07**

Q.2 **(a)** Discuss sources and impacts of following constituents of wastewater. **07**
(i) pH (ii) Total Solids (iii) BOD (iv) Fats, oils, and grease

(b) Write note on effluent disposal to Oceans. **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^oC 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. K'=0.25/d: k'_2=0.4/d. **07**

Q.3 **(a)** What do you mean by attached growth processes? Explain Trickling filter and Rotating biological contactors in detail. **07**

(b) Design a high rate trickling filter plant to treat settled domestic sewage with a BOD_5 of 220 mg/l for an average flow of 20mLd to satisfy an effluent BOD_5 of 10mg/l. take peak factor as 2.25. **07**

OR

Q.3 **(a)** Enlist various aerobic suspended-growth treatment processes. Discuss activated sludge process in detail. **07**

(b) Design a continuous- flow stirred-tank activated sludge process to treat 0.3 m^3/s of settled wastewater having 200mg/l of BOD_5. the effluent is to have 30mg/l of BOD_5. Assume that the temperature is 20^oC and that the following conditions are applicable. **07**

(i) Influent volatile suspended solids to reactor are negligible.
(ii) Ratio of mixed liquor volatile suspended solids to mixed liquor volatile suspended solids = 0.8
(iii) Return- sludge concentration = 10,000mg/l of suspended solids (SS)
(iv) Mixed liquor volatile suspended solids (MLVSS) = 3500mg/l
(v) Design mean cell residence time θc =10d
(vi) Effluent contains 22 mg/l of biological solids of which 65% is biodegradable.
(vii) The one day sustained peak flow rate is 2.5 times the average flow rate.

Q.4 **(a)** Explain Anaerobic Sludge-Digestion process in Deatil. **07**

(b) Estimate the size of digester required to treat the sludge from a preliminary treatment plant designed to treat 30,000m^3/d of wastewater. Check the volumetric loading, and estimate the percent stabilization and the amount of gas produced per capita. For the wastewater to be treated it has been found that the quantity of dry solids and BOD_L **07**

removed is 0.15kg/m^3 and 0.14kg/m^3,respectively. Assume that the sludge contains about 95% moisture and has a specific gravity of 1.02. other pertinent design assumptions are as follows:

1. The hydraulic regime of the reactor is continuous-flow stirred-tank.
2. θc = 10 days at 35^oC
3. Efficiency of waste utilization E=0.80
4. The waste contains adequate nitrogen and phosphorus for biological growth.
5. Y = (0.05-kg cells)/(kg BOD utilized) and k_d = 0.03 d^{-1}.
6. Constants are for a temperature of 35^oC.

OR

Q.4 **(a)** Discuss in detail any two methods of removal of dissolved inorganic substances. **07**

(b) Discuss in detail nitrification processes. **07**

Q.5 **(a)** Design a facultative stabilization pond to treat 500m^3/d municipal wastewater, BOD_5 220mg/l, from a town located in central India. Latitude 22 deg. N, elevation 100m above sea level. The average temperature in January is 18^oC. The effluent from the pond is to be used for irrigation. **07**

(b) Discuss membrane processes for wastewater treatment. **07**

OR

Q.5 **(a)** Write short note on Green Buildings. **07**

(b) Write short note on domestic reuse of wastewater. **07**

****