JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
SUPPLEMENTARY EXAMINATION (July - 2017)
M. Tech. (II- SEM.)

COURSE CODE: 14M31CE213
COURSE NAME: Industrial Wastewater Treatment
COURSE CREDIT: 3

MAX. MARKS: 100
MAX. TIME: 2 HRS

Note: Attempt all Questions. Carrying of mobile phones during exams will be treated as case of unfair means. Assume suitable data if required.

1. Determine the volume of equalization tank from the data given below. **(10)**

Time period	Volume of wastewater (m^3)
8-11	22.5
11-14	43.8
14-17	17.9
17-20	35.5
20-23	30.8
23-2	12.8
2-5	19.6
5-8	7.5

2. Estimate the total flow (m^3/day), BOD (kg/day) and total nitrogen (kg/day) received at a wastewater treatment plant using the following information (a) A population of 150000 with a water supply of 120lpcd with a BOD_5 generation of 54gpcd and Total N of 8gpcd (b) meat packing plant of 8000kg live weight/day. The flow required is 29 m^3/1000 kg of live packing and BOD_5 generation of 50kg/1000 kg of live packing and Total N of 6kg/1000 kg of live packing (c) Brewery producing 100,000 l/day of liquor with a flow requirement of 10litres per liter of beer, and BOD_5 generation of 8g/per liter of liquor and Total N of 0.3g per liter of liquor and (d) Cotton mill producing 90,000 kg/day with a flow requirement of 500 l/kg of cotton produced and BOD_5 generation of 150kg/1000 kg of cotton produced and Total N of 10kg/1000 kg of cotton produced **(10)**

3. Select an industry of your choice. For that selected industry describe (a) the main manufacturing processes of the industry (b) reasons for generation of effluent wastewater and (c) with neat flow sketches explain the treatment procedure followed by the industry. Also mention the disposal standards of wastewater effluent for that industry. **(10)**

4. Discuss the Cementation method for recovery of metals. In this context, with appropriate chemical reactions and graphical charts discuss the method for chromium recover including (a) reduction process, (b) precipitation technique and (c) other processes for removal. **(10)**

5 a) Design the volume of an equalization tank for an industrial wastewater flow rate of 20000 m^3/d. The average and maximum BOD concentration is 900 mg/l and 1300 mg/l respectively. The effluent from equalization basin should be less than 1000 mg/l. Statistically; it has been found that 84.1% probability of BOD occurs at 1100 mg/l and 15.9% probability of BOD concentration occurs at 650 mg/l. The 50% probability of BOD is 900 mg/l. Design at 95% probability conditions (Z = 1.65) **(5)**

5 b) A highly acidic wastewater has a flow rate of 0.45 m^3/min and requires neutralization prior to secondary treatment. A two stage lime control process will be used with first stage lime usage of 2000 mg/l and second stage usage of 500 mg/l. Determine (a) the total lime requirement for the treatment process and (b) the volume of the neutralization tank if detention time is 10 minutes. **(5)**

6 a) Derive an expression for A/S ratio in DAF system without recycling. Also mention the expression with recycling and explain the various terms **(5)**

6 b) The influent suspended solids concentration in an industrial waste is 1800 mg/l with a flow rate of 1500 m^3/day and is desired to have a removal efficiency of 90%. The A/S ratio is 0.04 and air solubility is 16.25. The surface loading rate is 15 l/m^2/min and recycled pressure is 4 kg/cm^2. Assume f= 0.70. Design the system and check for both non-recycling and recycling conditions **(5)**

7 Explain the process of neutralization. In context of acidic waste management, with neat sketches discuss the process of neutralization using (a) Equalization basin (b) Limestone bed and (c) Limestone tower. Also briefly explain the neutralization technique for an alkaline waste. **(10)**

8 a) An industrial wastewater consists of 50 mg/l of Cr^{+6} and 20 mg/l of Zn^{+2} ions. The flow rate is 300 m^3/d. The treatment method follows a SO_2 and lime process where 1.9 ppm of SO_2 and 2.4 mg of lime is required to treat 1 ppm of Cr^{+6} and 1.3 mg of lime is required to treat 1 mg of Zn^{+2}. Also 4 mg of SO_2 is required per mg of O_2. The DO of the wastewater is 7.5 mg/l. Using the above information determine (a) total SO_2 requirement (b) lime requirement and (c) total sludge production **(5)**

8 b) A metal plating firm has set up to remove zinc. They plan to use a pH meter to control feed a hydroxide solution to a mixing tank. Determine the pH value to set up a controlling unit to have an effluent Zn concentration of 1.2 mg/l. Assume K_{sp} of $Zn(OH)_2$ is 7.7×10^{-17}.
Note $[H^+]\,[OH^-] = 10^{-14}$ **(5)**

9 In the context of ammonia manufacturing, explain with a neat flow diagram the Haber Bosch process. Also explain the major sources of wastewater generation and treatment process for the same **(10)**

10 a) Define the term free reactive oxygen (O^*). Mention the chemical reaction for ultimate conversion of organic compound till mineralization using free reactive oxygen explaining all the terms. Using the above equation write balanced equation for phenol (C_6H_5OH) using H_2O_2 and MnO_4^-. **(1+1+1+1)**

10 b) In a neat tabular form, explain the different heavy metals, the forms in which they occur and the major industries producing them **(6)**