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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
MID-SEMESTER EXAMINATION (March- 2015)
M. Tech. (II- SEM.)

COURSE CODE: 14M31CE213 MAX. MARKS: 30
COURSE NAME: Industrial Wastewater Treatment
COURSE CREDIT: 3 MAX. TIME: 2 HRS

Note: Attempt all Questions. Assume suitable data if required.

Section A – (6 x 1 = 6 Marks)

1. Answer the following
   a) Explain the sequestration process for removal of heavy metals.
   b) Discuss the main reasons for providing an equalization basin.
   c) With neat graphical sketches, explain the method for determining the optimum bed depth.
   d) Explain the advantages for carbonate precipitation technique. Name two metals that can be precipitated with this technique.
   e) What are the major objectives of the chemical degradation process? Explain the drawbacks of the process.
   f) Explain the procedure for Dissolved Air Flotation (DAF)

Section B – (3 x 3 = 9 Marks)

2. In the context of anaerobic digestion, with appropriate chemical reactions discuss the four groups of microorganisms that sequentially degrade organic matter. Enumerate the factors that affect the anaerobic degradation process. **(3)**

3. a) Explain briefly the concept of (a) micro-screening and (b) ammonia stripping **(1.5)**

3. b) Explain the concept of grab sampling and composite sampling. In this context, explain the suitability of using a grab sampling or composite sampling on when they should be conducted **(1.5)**

4. 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. **(3)**

Section C – (5 x 3 = 15 Marks)

5. 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. **(3)**

6. a) Design the volume of an equalization tank for an industrial wastewater flow rate of 25000 m^3/d. The average and maximum BOD concentration is 950 mg/l and 1500 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 600 mg/l. The 50% probability of BOD is 900 mg/l. Design at 95% probability conditions (Z = 1.65) **(1.5)**

6. b) A highly acidic wastewater has a flow rate of 0.40 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 250 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. **(1.5)**

7. a) Derive an expression for A/S ratio in DAF system without recycling. Also mention the expression with recycling and explain the various terms **(1.5)**

7. 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 **(1.5)**

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 **(1.5)**

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 $[H^+]\,[OH^-] = 10^{-14}$ **(1.5)**

9. Design the volume of an equalization tank from the following data. **(3)**

Time Period	Average flow rate during the period (l/s)
24-01	275
01-02	221
02-03	164
03-04	130
04-05	105
05-06	99
06-07	119
07-08	204
08-09	354
09-10	411
10-11	425
11-12	430
12-13	425

13-14	405
14-15	385
15-16	351
16-17	326
17-18	326
18-19	328
19-20	365
20-21	399
21-22	399
22-23	379
23-24	345