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## MTEE - 202

M.E./M.Tech., II Semester

Examination, December 2015

### Waste Water Treatment - II

*Time : Three Hours*

*Maximum Marks : 70*

**Note :** i) Attempt any five questions.

ii) All questions carry equal marks.

iii) Assume missing data suitably.

a) Explain why the kinetic coefficients are determined. If  $Y=0.5\text{mg/mg}$ ;  $\mu_m=1.0\text{h}^{-1}$ ,  $K_s=210\text{mg/l}$ , and  $S_0=10,000\text{mg/l}$ , prepare a plot of the substrate and cell concentration versus the dilution rate.

b) For an aerobic process explain the following:

i) Oxidation

ii) Synthesis

iii) Endogenous respiration

2. Given the following design flow rates and primary effluent waste water characteristics, determine the all design parameters for a trickling filter. Design assuming two towers at 6.1m depth, cross flow plastic packing with specific surface area of  $90\text{m}^2/\text{m}^3$ , a packing coefficient  $n$  value of 0.5 and a

2arm distributor system the required minimum wetting rate =  $0.5 \text{ L/m}^3$ . Assume a secondary clarifier depth of 4.2m. Design condition:

| Item       | Unit                  | Primary effluent | Target effluent |
|------------|-----------------------|------------------|-----------------|
| Flow       | $\text{m}^3/\text{d}$ | 15100            |                 |
| BOD        | $\text{g/m}^3$        | 150              | 20              |
| TSS        | $\text{g/m}^3$        | 60               | 20              |
| Min. Temp. | $^{\circ}\text{C}$    | 15               |                 |

3. a) Name and describe the most common methods available for volume reduction of sludge.
- b) Name and describe the most common methods of sludge disposal.
4. a) Explain with sketch the working and limitations of facultative pond.
- b) Design a facultative pond system to treat  $20,000 \text{ m}^3/\text{day}$  of domestic sewage, with  $\text{BOD}=320\text{mg/l}$ . Design temperature is  $20^{\circ}\text{C}$  and required effluent standards are  $\text{BOD}_5 < 50 \text{ mg/l}$ ,  $k_1 = 0.3\text{d}^{-1}$  at  $20^{\circ}\text{C}$ .
5. a) Enlist the methods and explain the process of thickening of sludge.
- b) A digester with a capacity of  $45,000 \text{ kg/day}$  of sludge is to be treated by circulations of sludge through an external hot water heat exchanger. Assuming that following conditions apply find the heat required to maintain the required digester temperature. If all heaters were shutoff for 24 hours, what would be the average drop in temperature of the tank contents?

- i) Concrete digester  $D=18\text{m}$ , side depth =  $6\text{m}$ , mid depth =  $9\text{m}$ .
- ii) Heat transfer coefficients,  $U = 0.68 \text{ W/m}^2. ^{\circ}\text{C}$  for entire depth,  $U=0.85\text{W/m}^2. ^{\circ}\text{C}$  for floor,  $V = 0.91 \text{ W/m}^2. ^{\circ}\text{C}$  for roof exposed to air.
- iii) Temps Air =  $-5^{\circ}\text{C}$ , Earth next to wall =  $0^{\circ}\text{C}$   
Incoming sludge =  $10^{\circ}\text{C}$ , earth below floor =  $5^{\circ}\text{C}$   
Sludge contents in digester =  $32^{\circ}\text{C}$
- iv) Specific heat of sludge =  $4200 \text{ J/kg } ^{\circ}\text{C}$
6. a) Differentiate between aerated lagoon and oxidation ditch
- b) Explain the effects of recirculation in trickling filter.
7. a) Explain different technologies used for advanced treatment of waste water.
- b) Discuss the process of Nitrogen removal of refractory organisms.
8. Write short notes on any four of the following:
  - a) Bacterial growth and different phases
  - b) Stabilization pond
  - c) Design details of Nitrogen gas filled growth denitrification column
  - d) Low cost options for waste water treatment systems
  - e) Standard rate and high rate digestion

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