University Of Technology
Building and Construction Eng. Dept.
Final Exam-First Attempt–2015/2016

Branch :Building & construction Management Eng. **Class: Third**

subject : Sanitary Engineering **Time : 3 Hours**

Examiner: Lec. Ghufran F. Jumaah **Date : 11/ 6 /2016**

((Answer Four questions including Q2))

Q1. Explain the following and support your answer with useful equations and graphs where it is necessary:

1. Ideal settling basin
2. Grit removal in W.W.T.P.
3. Factors affecting water use.
4. Factors that the type of pipes is depending on. (25mark)
5. Chemical characteristics of wastewater

Q2. Choose the correct answer. (25mark)

1. BOD is .....
   a. The required oxygen to destroy organic materials by bacteria.
   b. The required concentration of organic material to increase bacteria.
   c. The concentration of dissolved oxygen in water.
2. Turbidity is one of the most .....characteristics of water.
   a. Chemical b. biological c. physical.
3. Screen, comminutor and grit removal are defined as .....in W.W.T.P.
   a. Primary treatment
   b. Secondary treatment
   c. Preliminary treatment.
4. ..... are removed in Primary sedimentation tank in W.W.T.P.
   a. Most of organic and suspended materials.
   b. 30% of BOD and 60% of suspended solid.
   c. 70% of BOD and 30% of suspended solid.
5. The success design of network must be including .....
   a. Satisfy the required demand.
   b. Safety construction under pressure and economic.
   c. All of the above.
6. Max. Daily of water flow requirements is equal to .....
   a. 1.8 Q avg.
   b. 1.8 Q max.
   c. None of the above
7. Scouring velocity in W.T. must be limited to a value .....
   a. Less than velocity that cause sand resuspended.
   b. More than velocity that cause sand resuspended.

c. None of the above.

8. SOR in settling tank equals to:
   a. Q / hL b. Q / WL C. Q / WH.
9. Pumps may be classified according to ……..
   a. Principle of operation and method of drive
   b. Head , capacity, and type of construction.
   c. All of the above.
10. Aluminum sulfate is ……
   a. One of the disinfectant materials.
   b. One of the coagulants materials.
   c. None of the above

Q3. An activated sludge plant treating 1000m3/day with influent BOD of 210 mg/l and S.S of 260 mg/l

1. Design primary clarifier when the removal efficiency of S.S is 70%.and detention time is 3 hr
2. Estimate the total sludge production per day from the plant. Assume that primary clarifier removes 30% and 60% of the influent BOD and S.S respectively. Sludge moisture content is 90%. (25mark)

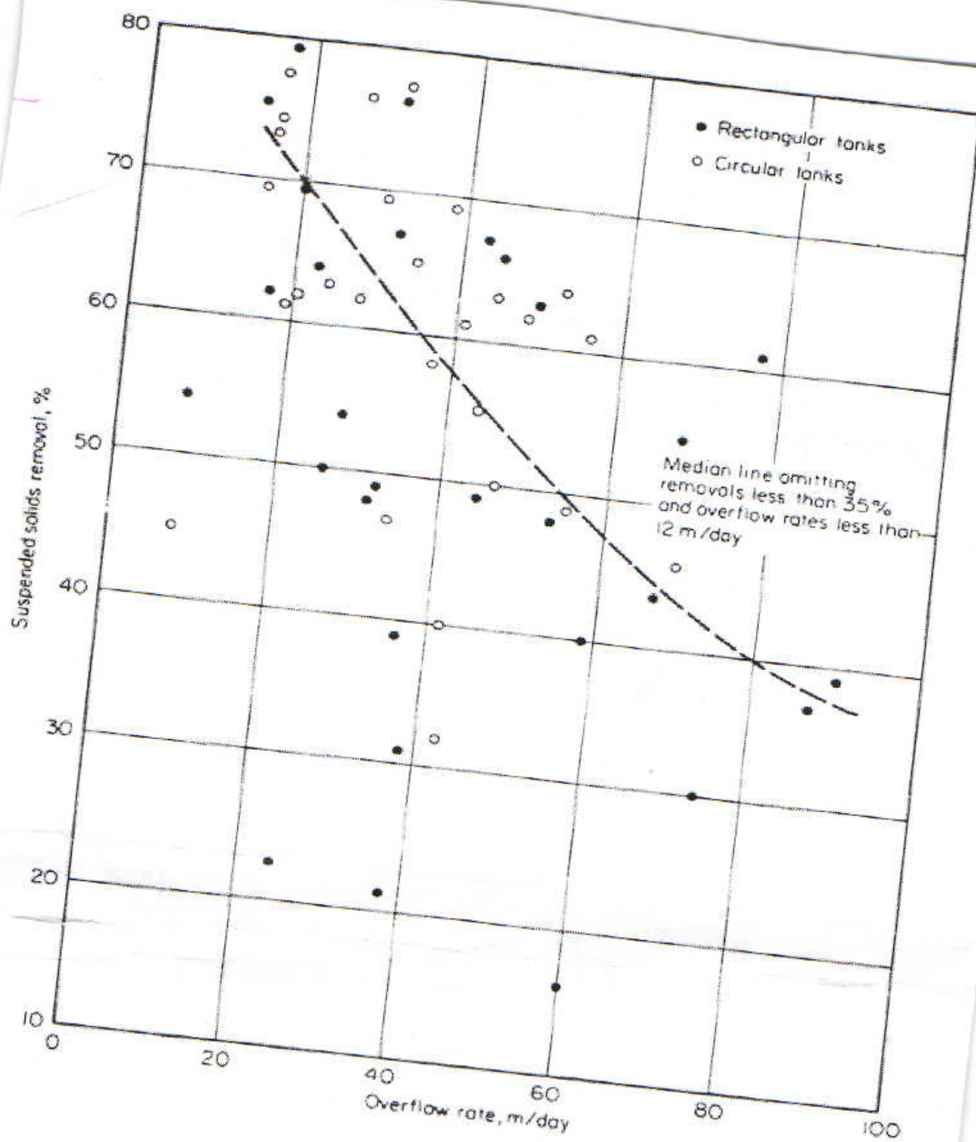
Q4. A. State five of the steps that involved in water and wastewater treatment plant design. (10mark)

B. Wastewater with BOD_5 of 100 mg/l is discharged to a stream with an average temperature 35C°. What would be the BOD in 5 days and how long would be required for the same degree of stabilization if the temperature is 5C° $K_{(20)}$ =0.25/day. (15 mark)

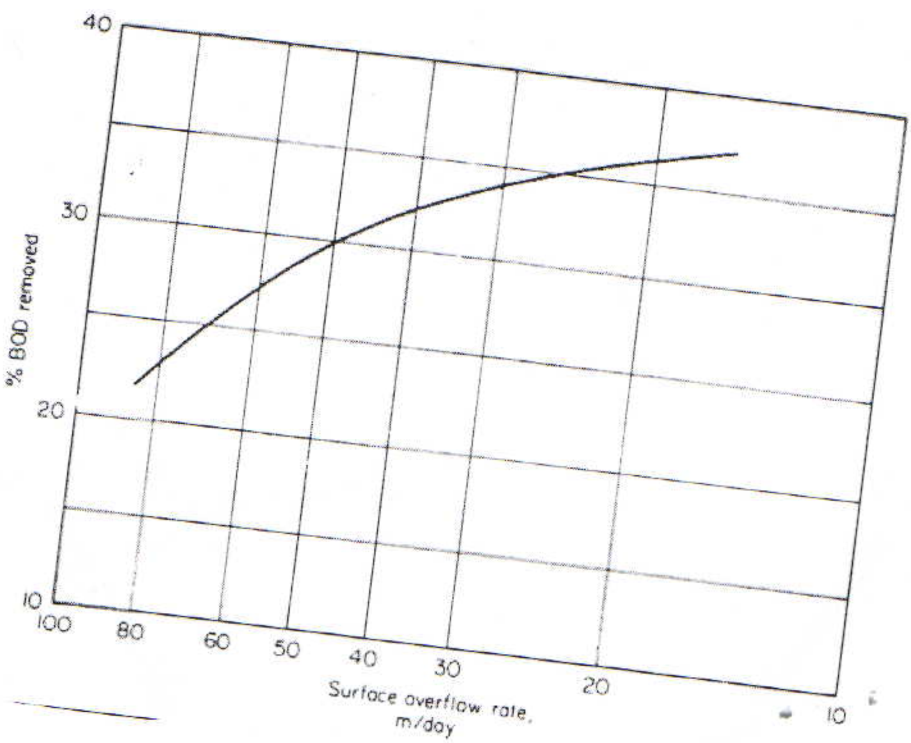
Q5. A. what is the chlorination's break point? (10 mark)

B. A dual media filter contains anthracite with an effective size of 1.2mm and a uniformity coefficient is 1.5, what must be size of underlying sand layer if the anthracite is to remain on top. S. g. of sand = 2.6 (15 mark)

Good Luck



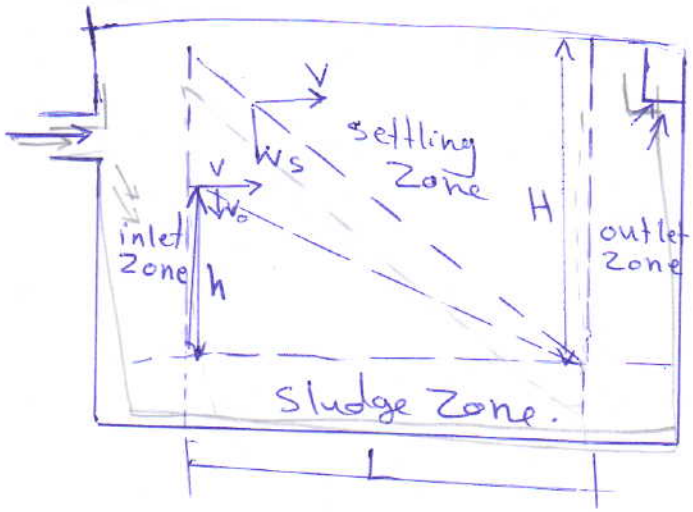
Suspended solids removal, %
Overflow rate, m/day
Rectangular tanks
Circular tanks
Median line omitting removals less than 35% and overflow rates less than 12 m/day



% BOD removed
Surface overflow rate, m/day

Q1. Explain the following

1. Ideal settling basin



2. Grit removal in W.W.T.P

material such as sand, metal, --etcare removed in Grit removal device depending on the defference in specific gravity between organic and inorganic Solids according to Newton's Law.

$$V_s = \left[\frac{4g(\rho_s - \rho)d}{3C_D\rho}\right]^{\frac{1}{2}}$$

and to be scoured at a velocity

$$V_h = \left[\frac{8\beta(s-1)gd}{f}\right]^{\frac{1}{2}}$$ so to ensure grit removal from waste water horizonal Vh must be closed to but Less than the scour velocity of grit.

3. Factors effecting water use.

① size of the community
② presence of industries
③ quality of the water and maintenance
⑤ its cost, pressure and the climate.
⑥ charcteristics of population

④ Factors that type of pipes depend on.

① pressure under pipe
② cost
③ head loss
④ construction method
⑤ change the pipe properities.

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⑤ Chemical characteristics of wastewater

① wastewater contains both organic and inorganic chemical (organic consistes of carbohydrates, proteins, fats –
② Nitrogen compounds
③ phosphorous compounds
④ the alkalinity of wastewater

Q2- choose the correct answer

1. a 2. c 3. c 4. b 5. c
6. a. 7. a. 8. b 9. c 10. b

Q3- Solu: ① From the fig. for 70% of S.S Removal

SOR = 20 m/d

$$A = \frac{Q}{SOR} = \frac{1000}{20} = 50\ m^2$$

$$D = \sqrt{\frac{4A}{\pi}} = \sqrt{\frac{50 \times 4}{3.14}} = 7.98 \simeq 8\ m$$

$$V = Q * D.t = 1000 * 3/24 = 125\ m^3$$

$$Depth = \frac{V}{A} = \frac{125}{50} = 2.5 + 0.5 \text{ free board}$$

$$= 3\ m$$

2. Solid production

① From primary

sludge = $0.6 \times (260 \times 10^{-3}) \times 1000 = 156$ kg/d

from secondary

sludge = $0.5\,(0.7)(210) \times 10^{-3} \times 1000 = 74$ kg/d

Total sludge = $156 + 74 = 230$ kg/day

solid content = 10%

Real sludge quantity = $\frac{230}{0.1} = 2300$ kg/day

Q4. A.

① synthesis of alternative flow sheets
② bench test and pilot ~~Criteria~~ studies
③ sizing of the physical facilities
④ preperation of profiles
⑤ Layout of physical facilities
⑥ preparation of solid balances
⑦ preparation of construction drawing, specification and cost estimates
⑧ selection of design criteria.

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B. Solu: $K_1(T) = K(20)(1.047)^{T-20}$

$K(35) = 0.25(1.047)^{35-20} = 0.49$ /day

$K(5) = 0.25\,(1.047)^{5-20} = 0.125$ /day

$L_4 = BOD_5 / 1 - e^{-kt} = 100 / 1 - e^{-.25(5)} = 140$ mg/l

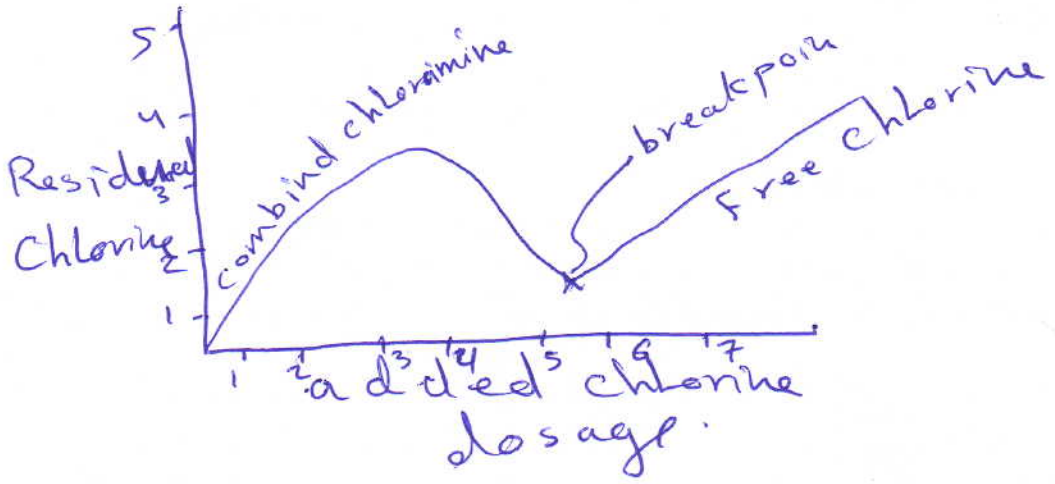
BOD at 35°C $= 140\,(1 - e^{-.49(5)}) = 127$ mg/l

at 5°C $BOD = 140\,(1 - e^{-.125(t)})$ ⟹ $127 = 140\,(1 - e^{-.125\,t})$

$t = 18.4$ day

Q5. A

Break point chlorination involves addition of chlorine in an amount sufficient to react with any amonia and readily oxidizable organic which are present



B. ——— solu:

$$\frac{d_1}{d_2} = \left[\frac{\ell_2 - \ell_w}{\ell_1 - \ell_w}\right]^{2/3}$$

$$d_{sand} = 1.2\left[\frac{1.5-1}{2.6-1}\right]^{2/3} = 0.55\,mm\,(D_{10})$$