



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

Branch :Structural Eng.
subject : Sanitary Engineering
Examiner : Lec. Rana J. Kadhim

Class: Third
Time : 3 Hours
Date : 15 /6/2016



Note:- Answer Four questions only

Q1:-A/ Determine the maximum daily consumption and fire demand in (l/c/d) for a community of 22000 capita, has an average Consumption is 600 l/c/d and fire flow dictated by a 6 story ordinary construction building of a floor area of 1000m²/story.

(12.5 marks)

B/ Explain briefly the following terms:

- 1- The types and sources of water impurities.
- 2- The characteristics of sand and gravel used in filter media.
- 3- The methods used for population forecasting.
- 4- The common methods used for disinfection of water.
- 5- Physical characteristics of sewage

(12.5marks)

Q2:- A/ The following data was obtained in a chlorination experiment. Plot the data and determine the break point dosage.

Dosage (mg/l)	1.0	2.0	3.0	4.0	5.0	6.0	7.0
Residual(mg/l)	0.8	1.55	1.95	1.25	0.5	0.85	1.95

What dosage is required to provide a free residual of (1) mg/l.

(12.5marks)

B/ Define only the following terms:

- 1- Trickling filters.
- 2- Coagulation and Flocculation.
- 3- Biochemical oxygen demand.
- 4- Surface overflow rate.
- 5- Breakpoint chlorination.

(12.5marks)

Q3:-A/ A stream has a flow of 0.5 m³/s, BOD concentration is 3 mg/l , temperature 22°C and DO 8 mg/l , a waste water spilled into the river with a flow of 15000 m³/d , BOD concentration 40 mg/l, temperature 25°C and DO 2 mg/l. at 20°C, k₁ for the mixture 0.23 /d , k₂ for the river 0.4 /d. Find Critical dissolved oxygen deficit and the distance it happens if the average velocity of flow is 0.2 m/s.(saturated level of oxygen is 8.7 mg/l).

(12.5marks)

B/ Draw a sketch showing the method of filtration and back washing of filters (R.S.F.) (12.5 marks)

Q4:- A/ A treatment plant uses 12 R.S.F. of a capacity of $4000 \text{ m}^3 / \text{d}$ for each filter. The filtration rate is $160 \text{ m}^3 / \text{d}$ and the backwash rate is $864 \text{ m}^3 / \text{d}$. Each filter is designed with two troughs of a square cross Section find:-

- 1- Dimensions of each filter.
- 2- Dimensions of each trough.

(12.5marks)

B/ State only the following terms:-

- 1- The factors that affect the coagulation process.
- 2- The Factors that must be considered in the location of water intakes.
- 3- Types of settling tanks.
- 4- The physical factors affect process of self- purification of stream.
- 5- The Factors affecting water consumption.

(12.5marks)

Q5:-A/ A rectangular sedimentation tank, $L=30\text{m}$, $W=16\text{m}$ and $H=4\text{m}$ is designed to treat $12000 \text{ m}^3 / \text{d}$, the effluent weir length= 60m . Find:-

- 1- Detention time.
- 2- Weir loading.
- 3- Surface over flow rate.
- 4- Settling velocity of a particle entering at the top and reaching the bottom at mid length of tank.

(12.5marks)

B/ 1- Draw a sketch showing bacterial growth curves based on (number and mass of organisms).

2- Draw a sketch showing (units) of conventional water treatment plant.

(12.5marks)

Useful information:-

$$D_t = \frac{k_1 l a}{k_2 - k_1} (10^{-k_1 t} - 10^{-k_2 t}) + D_a 10^{-k_2 t}$$

$$r = \frac{Q_r}{Q}$$

$$T_c = \frac{1}{k_2 - k_1} \log \left\{ \frac{k_2}{k_1} \left(1 - \frac{D_a (k_2 - k_1)}{k_1 L a} \right) \right\}$$

$$G = \left(\frac{P}{\mu V} \right)^{0.5}$$

$$D_c = \frac{k_1}{k_2} L a * 10^{-k_1 T_c}$$

$$y = 1.73 \sqrt[3]{\frac{Q_b^2}{g b^2}}$$

$$XV = \frac{Y Q (S_0 - s) \theta_c}{1 + K_d \theta_c}$$

$$\text{vol. of air required} = \frac{\text{wt. of } O_2}{\% O_2 \times \rho_{air}}$$

$$\frac{dx}{dt} = \frac{xV}{\theta_c}$$

$$O_2 \text{ demand} = 1.47 (S_0 - S) Q - 1.14 X_r Q_w$$

$$Q_r = \frac{Q_x}{X_r - X}$$

2015/2016 حلول امتحان الأحياء - الور الأول للعام
 فرع الهندسة الاستوائية
 المرحلة: الثالثة
 المادة: الهندسة الهيدروليكية

Q1:- A1 sol.

$$\text{Average domestic demand} = 22000 \times 600 = 13.2 \times 10^6 \text{ l/d}$$

$$\text{Maximum daily demand} = 1.8 \times \text{ave.} = 23.76 \times 10^6 \text{ l/d}$$

$$F = 18C \sqrt{A}$$

$$= 18 \times 1 \times \sqrt{10000 \times 10.76 \times 6} = 4574 \text{ gpm} = 17288 \text{ l/min}$$

$$= 24.89 \times 10^6 \text{ l/d}$$

$$\text{Maximum Rate} = 23.76 \times 10^6 + 24.89 \times 10^6$$

$$= 48.65 \times 10^6 \text{ l/d} = 2211 \text{ l/c/d for 10hrs}$$

the total flow required during this day would be:-

$$23.76 + 24.89 \times \frac{10}{24} = 34.13 \times 10^6 \text{ l} = 1551 \text{ l/c/d}$$

Comparative method

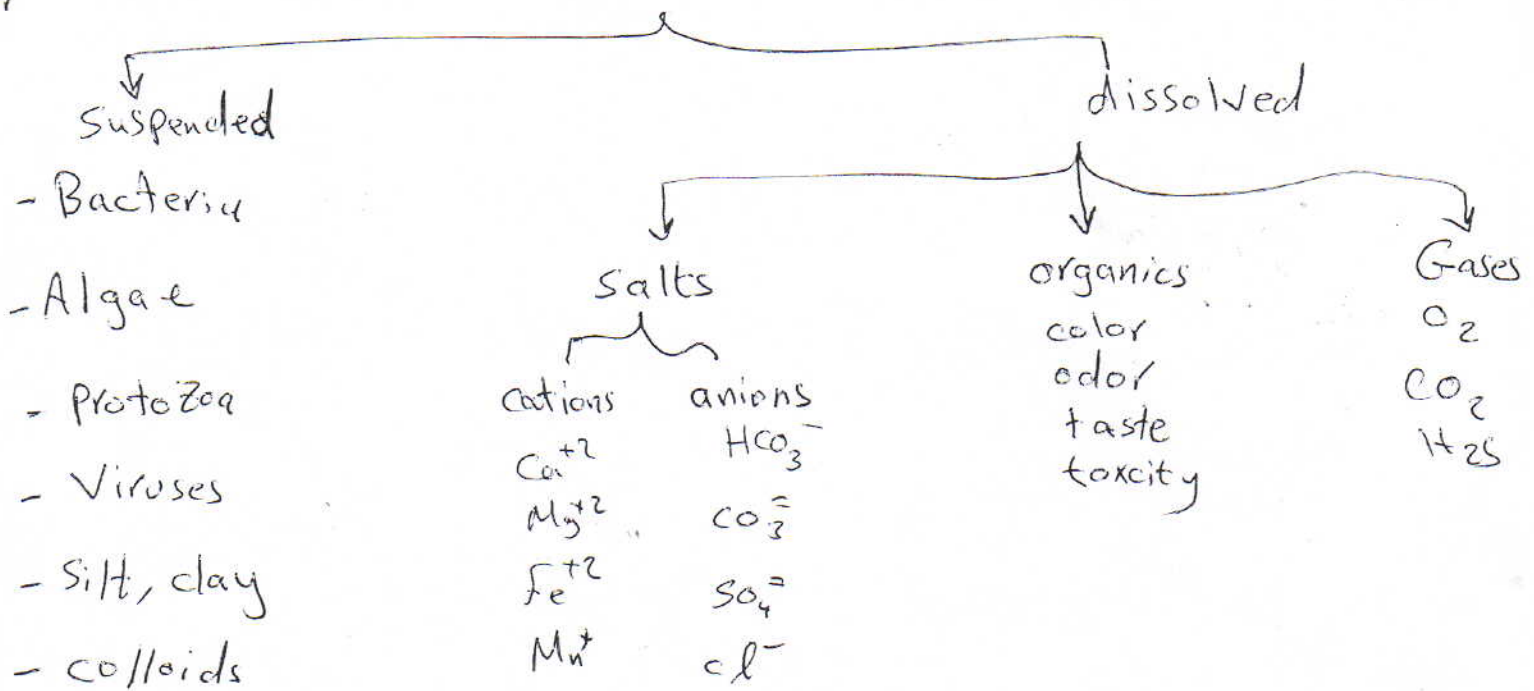
Ratio and Correlation method:

$$\frac{P_j}{P_j'} = \frac{P_i}{P_i'} = k \text{ (constant)}$$

Q/D/B

2/

Impurities of Water



Q1/B

2/

خصائص الرمل والحصى

الرمل : أ، هي مادة كوسط للتدريج، خالي من الأوساخ، هلب، مقاوم بلوري، لا يفقد أكثر من 5% من الوزن بعد غسلها بماء HCl نسبة 100% معلقة في سائبة، مخفف الرمل 60 - 70 سم و حجم مؤثر 0.45 - 0.55 mm
عازل التيارات لا يتجاوز $1.7 \leq U.C. \leq 1.2$

الحصى : يوضع الحصى تحت أو ستة طبقات حيث تكون الطبقات العليا حاوية على الحصى الجيد، هلب، معدود، مقاوم، الوزن التقريبي 1600 كغم خالي من الشوائب، غير حاوي على الألياف، الرمل، تراب صخرية، قواقع أو مواد خزفية، حجم 400 - 600 mm

Q1:- B/

3-

Graphical method, Arithmetic method

$$\frac{dp}{dt} = k_a$$

$$dp = k_a dt$$

$$P_f = P_i + k_a (t_f - t_i)$$

$$\therefore k_a = \frac{P_f - P_i}{t_f - t_i}$$

Geometrical method $\frac{dp}{dt} = k_g P$

4- / وسائل التقييم ⑤ الطرق الفيزيائية وتقييم المعالجة بالحرارة

وترفع درجة الحرارة الى 100°م ولمدة 15 - 20 دقيقة لغلي الجراثيم

- استخدام الأتفة فوق البنفسجية حيث تترك المياه في غرفة تعريضها فوق الأتفة

فوق البنفسجية بطول موجة 200 - 360 نانومتر

- استخدام أيونات المعادن مثل الفضة والنحاس

- شعة الشمس

⑤ الطرق الكيميائية: وتضمن المواد الكيميائية المتكسدة (مركبات ستينيل

الالكترونيات لتطهير المياه، ومثلاً ذلك غاز الكلور ومركبات الكلور، الاوزون

اليود، برصينات البوتاسيوم لتطهير المياه)

Q1:- B/

5/ Physical characteristics

sewage is 99.9% water, but the remaining material has very significant effects fresh domestic sewage

slightly soapy

oily odor

cloudy, contains recognizable solids, a considerable size

state sewage, has a pronounced odor of H_2S

dark grey, contains smaller but occasionally recognizable

suspended solids.

Q2:- A/ Sol.

