Mansoura University

Mechanical Power Engineering Dept.
Third Year, Mechanical
Fall Semester2013/2014

Faculty of Engineering

Final Exam. Total Marks: 60	**WATER TREATMENT TECHNOLGY**	Time Allowed: **2 hours** Date : 15-1-2014

Answer the following questions:

Question No. 1: (12 marks)

A. What are the main objectives of the drinking water treatment? And what are the different uses of the municipal water?

B. A 5-story building of ordinary construction of 1000 m^2 of ground area communicating with a 3-story building of ordinary construction of 1200 m^2 ground area. Compute the required fire flow. (take the construction coefficient, C = 1)

C. Assuming a high-value residential area of 100 ha has a housing density of 10 houses/ha with 4 persons per household, determine the peak water demand, including fire, in this residential area. (take the consumption per capita for residential, public service and unaccounted = 220, 30 and 90 liter/day respectively)

Question No. 2: (18 marks)

A. A rapid mixing tank is 1 m x 1 m x 1.2 m. The power input is 746 W (1 hp). Find the *G*-value at a temperature of 10°C. (At 10°C, μ = 0.00113 N.s/m^2)

B. A flocculator is 4.88 m deep, 12.2 m wide, and 24.4 m long. The flow of the water plant is 0.57 m^3/s. Rotating paddles are supported parallel to four horizontal shafts. The rotating speed is 2.0 rpm. The center line of the paddles is 1.68 m from the shaft (mid-depth of the basin). Each shaft equipped with six paddles. Each paddle blade is 25 cm wide and 11.6 m long. Assume the mean velocity of the water is 28% of the velocity of the paddles and their drag coefficient is 1.9. Estimate:

   (a) the difference in velocity between the paddles and water
   (b) the useful power input
   (c) the energy consumption per m^3 (W.hr/m^3)
   (d) the detention time
   (e) the value of *G* and *Gt* at 20°C
   (f) the loading rate of the flocculator

C. A rectangular clarifier to be designed for a rapid sand filtration plant of a capacity flow is 30000 m^3/day. The surface loading is 24.4 m^3/m^2/day and the detention time is 6 hours. If length to width ratio for the clarifier is 2:1. Determine the dimensions of the clarifier.

Question No. 3: (15 marks)

A. Discuss the different mechanisms and theories by which the suspended solids can be retained through the sand filters media.

C. A city is to install rapid sand filters downstream of the clarifiers. The design loading rate is selected to be 160 $m^3/(m^2 \cdot d)$. The design capacity of the waterworks is 0.35 m^3/s. The maximum surface per filter is limited to 50 m^2. Design the number and size of filters and calculate the normal filtration rate.

D. A filter unit has surface area of 5 m wide and 9 m long. After filtering 10,900 m^3 for 50 h, the filter is backwashed at a rate of 0.65 m/min for 15 min. Find: (a) the average filtration rate, (b) the quantity of washwater, (c) percent of washwater to treated water, and the flow rate to each of the four troughs.

Question No. 4: (15 marks)

A. What are the main factors that should be considered for selecting the disinfectant matter?

B. For a water treatment plant of a town of population 50000 capita and average water consumption 200 liter/c/d. find

1- The amount of chlorine gas per day for final chlorination (the chlorine dosage for final chlorination is 2-3 mg/liter)

2- if the hypochlorite with 65% efficiency of chlorine gas is used find the required daily amount.

C. It is required to design a chlorine contact tank for disinfection water with flow rate of 36000 m^3/day with a contact time of 25 min. Find the dimension of this chlorine contact tank if its width is 2.5m and it has six baffle walls in its mid span with thickness of 0.25 m and clear width between baffles = 2.5 m.

BEST WISHES

Dr. Kamal El-Nakkas

"بسم الله الرحمن الرحيم"

Mansoura University
Faculty of Engineering
Mechanical Power Engineering

Grade Four
Petroleum Engineering Module
First Term Final Exam.
Date: 15/1/2014

TIME ALLOWED: THREE (3) HOURS

Answer (A) or (B) from each of the following questions and also part (c) of each question is obligatory to be answered :

Question (I) :

A- Divide the petroleum industry structure according to the "API".
B- Tabulate proportions of chemical elements representing petroleum composition.
C- Mention the different methods of wells artificial lift and factors affecting selection of its equipment.

Question (II) :

A- Classify the main topics of the hydrocarbon traps. Illustrate your answer by schematic presentation for each type of each topic .
B- Define the term "Petroleum prospect" and outline the main elements which have to be present for a prospect to work effectively .
C- What is the concept of progressive cavity pumping. Draw sketch of system used

Question (III)

A- calculate the Stock-Tank oil initially in place for oil reservoir having the following parameters :

- Area of the reservoir 5,130,000 ft^2
- Thickness of the reservoir 100 ft
- Net/Gross ratio of the formation thickness 0.60
- Porosity 0.20
- Water saturation 0.30 .
- Oil formation volume factor 1.1 rbbl / STB.

B- What are the purposes of the well control system during petroleum drilling phase ? What are the different types of this system ?
C- Outline the main technical topics for oil recovery methods including their subdivisions.

Question (V)

A) What are the different types of well completion ? Illustrate your answer by tabulating the main advantages and disadvantages of each type.
B) What are the main objectives of well logs interpretation .
C) Explain briefly the main techniques utilized for chemical enhanced oil recovery .

مع أطيب تمنياتى بالنجاح والتوفيق ،،،

Dr. M. Ali Badawy

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FORMULA SHEET

Population Estimation

Arithmetic increase

$$\frac{dP}{dt} = k_a \qquad P_n = P_1 + k_a(t_n - t_1)$$

Geometrical increase.

$$\frac{dP}{dt} = k_p P \qquad \ln P_n = \ln P_o + k_p(t_n - t_o)$$

Decreasing rate of increase

$$\frac{dP}{dt} = k_d(P_S - P) \qquad k_d = -\frac{1}{t_2 - t_1}\ln\frac{P_s - P_2}{P_s - p_1} \qquad P_n = P_o + (P_s - P_o)(1 - e^{-k_d t})$$

Fire Demand

$Q = 3.68\sqrt{p}(1 - 0.01\sqrt{p})$ where Q discharge, m^3/min, P population in thousands

$F = 320C\sqrt{A})$ *where* F required fire flow, m^3/d, C coefficient related to the type of construction, A total floor area, m^2

Head loss through bar screen $h = \frac{1}{0.7}\frac{V^2 - v^2}{2g}$

Detention time (t) = volume/flow rate

The G-value, $G = \sqrt{\frac{P}{\mu V}}$

The **velocity of paddle** blades (v_p) $v_p = \frac{2\pi rn}{60}$

The **useful power input** $P = \frac{1}{2}C_D \rho A v^3$ A = area of the paddles, m^2, v = velocity difference between paddles and water, C_D = drag coefficient, ρ = density.

Filter loading rate, $m^3/m^2 . d = Q/A$