Mansoura University
Faculty of Eng.
Public Works Eng. Dept.

4th year, Civil Eng.
Sanitary Eng.
Time : 3.0 Hrs

2- 6 – 2013 - رابعة مدنى

General Instructions (الامتحان في صفحتين + صفحتين منحنيات)

The total marks of the exam is (90) marks
Any missing data can be reasonably assumed

1- a) Describe with neat sketch for the following: (8 marks)

- Horizontal and vertical baffling type flocculator.
- inlet and outlet zones of rectangular sedimentation tank.
- Velocity Gradient (G).
- tapered flocculation.

b) Mark (√) the correct sentence and (X) the wrong one with the correction (4 marks)

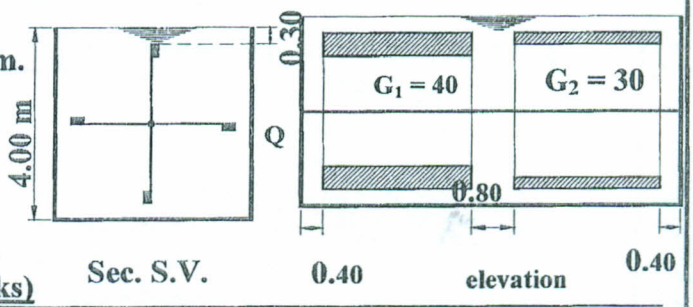
-Friction coefficient (C) whose value depends on the type pipe only.
-The optimum pH range for ferric sulfate must be raised to 9.5.
-The zeta potential is a direct measure of the electrical charge of the colloidal particle.
-Colloids – so small: gravity settling is not possible.

2-a) Design a rectangular flocculator sedimentation tank for supplying water to population of 80000 capita with an average water consumption of 220 l/c/d. Assume for sedimentation tank, surface loading rate of 30 $m^3/m^2/d$ and detention time = 2.5 hrs. (7 marks)

b) A flocculator basin in figure is rotated through water with an angular speed 5.0 rpm. If the flow is 12000 m^3/d and Gt $=4.5 \times 10^4$ ($\mu = 1.002 \times 10^{-3}$ N.S/m^2), determine:

- the basin dimensions.
- the power dissipated into water.
- the paddle configuration.

(6 marks)



3- a) Draw cross section elevation of dual-medium gravity rapid filter showing all pipes and valves. (2 marks)

b) Explain the purpose of the different locations of disinfectant injection in the water supply systems. (2 marks)

c) A water treatment plant produce 100000 m^3/d. The dual media filter unit has an area of 48 m^2 , its filtration rate is 9.0 m/hr, the water backwash rate is 26 $m^3/m^2/hr$ for 12 minutes.

1. Determine the total number of filter units. (2 marks)
2. Determine quantity and percent of backwash water. (2 marks)

4-a) Draw the cross section elevation of balancing elevated tank showing all pipes and valves. (2 marks)

b) A city with a population of 0.50 million has a continuous water supply. The average daily demand of the capita in this town is 200 l/d consumed as shown in the table. Determine the capacity of the elevated tanks required in the following cases :

1- high lift pumps works with uniform rate for 24 h/d,
2- high lift pumps works with uniform rate for 18 h/d.

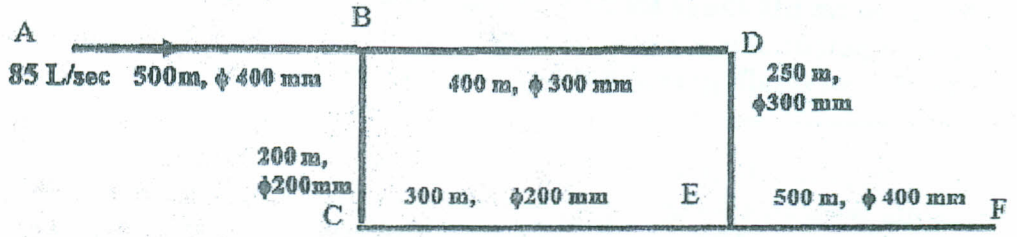
Suggest other case to more minimize the capacity of the elevated tanks and calculate it. (6 marks)

Time	Rate (L/4hr)	Time	Rate (L/4hr)
12 M.N – 4 A.M	16	12N – 4 P.M	48
4 – 8	30	4 – 8	38
8 – 12 N	58	8 - 12 MN	10

5- a) Fill the empty space: (3 marks)

1. The water distribution network modes are : 1 -……., 2-……, 3-……, and 4-…….
2. The economic velocity range through pipe network is ……
3. Value of the force acting on thrust blocks depends upon : 1- ……., and 2-…….
4. The minimum inner height of valve chamber is ……
5. Field pipe pressure test run at pressure equal to …… operation pressure.
6. Water leak detection and repair programs save …….. and……..

b) For the following water distribution network (Q = 85 L/sec), estimate the height of the elevated tank which will be constructed at point (A) to have water pressure at point F = 2.5 kg/cm^2 , considering the value of the minor losses is 3.0 m . (4 marks)
If the discharge (Q) is increased to meet future demand, what are your suggestions to maintain the pressure at point (F) equal to its original value? (2 marks)



6-a) What are the composition of Soluble organics in domestic wastewater (3 marks)

b) Write brief notes on:

-Types of collection systems -Factors governing the design of gravity sewers
-A lateral sewer and a main sewer (6 marks)

c) A circular combined sewer is to carry 0.35 m^3 /sec. When running 2/3 full at max. W.W.F. and 0.10 m^3 /sec at min. D.W.F. Determine the diameter and minimum slope of the sewer. Calculate the velocity and depth of sewage flow at maximum W.W.F. and minimum D.W.F. Determine also the diameter of pumping station to meet the Max. D.W.F of the main sewer if θ=10min. and d = 2.0 m. (8 marks)

d) Design and check all dimensions of the following treatment units in sewage treatment plant :
i)Approach channel . ii) Grit Chamber iii) primary sedimentation tank
Given the following data: (8 marks)
Qave. = 100000 m^3/d., Qmax. = 180000 m^3/d., Over flow rate of grit chamber = 1200 m^3/ m^2/d

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7-a) Draw block processes diagram of sludge treatment . (2 marks)

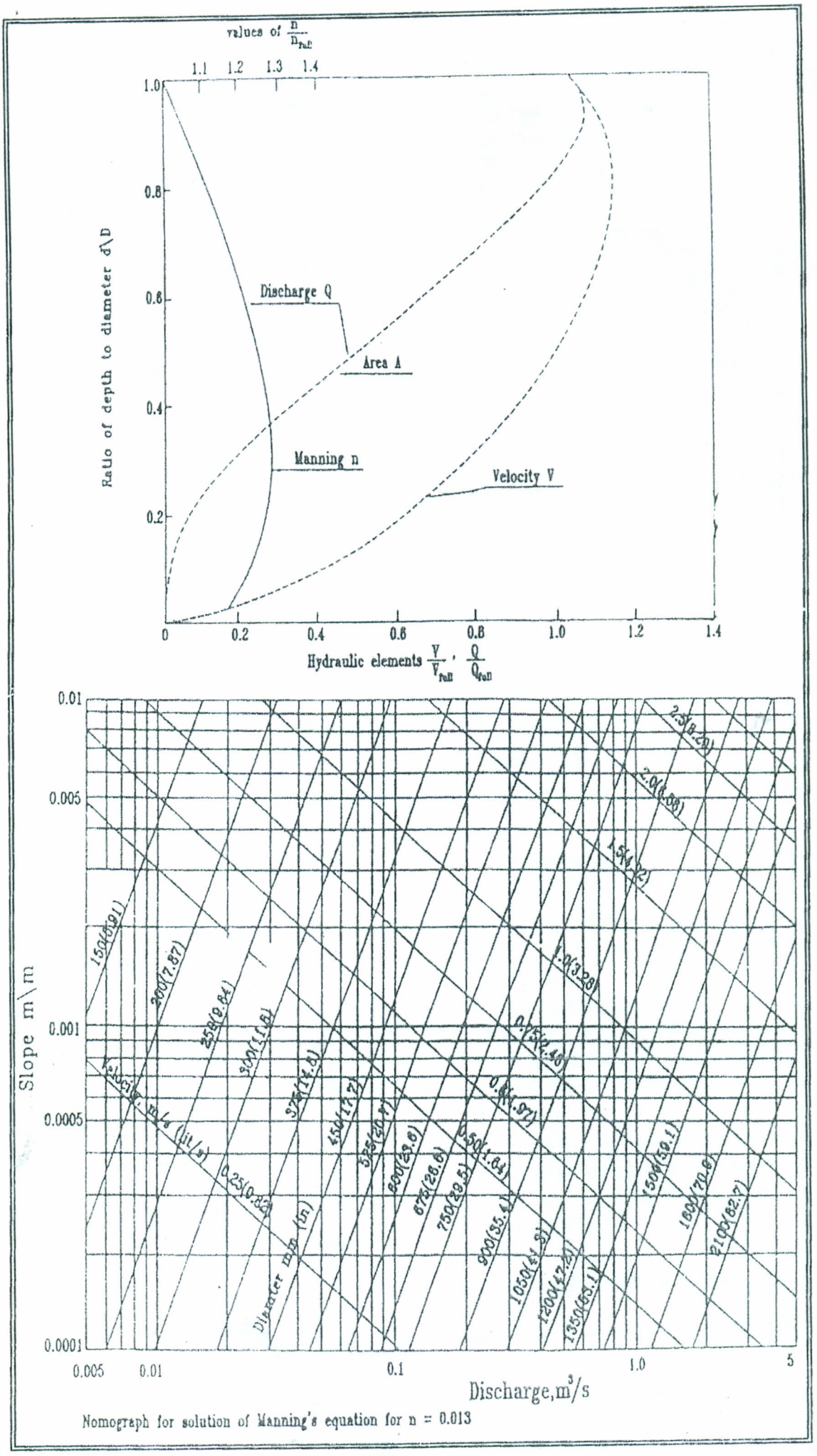
b) Mark (√) before the correct sentence and (X) before the wrong one (6 marks)
يتم كتابة رقم كل عبارة فقط في سطر منفرد بورقة الإجابة متبوعة بشرطة ثم علامة صح أو خطأ

1-	( )	In wastewater biological treatment the colloidal and dissolved biodegradable solids are converted to biomass.
2-	( )	Nitrification and denitrification processes can be achieved in sequence places in oxidation carrousel ditch.
3-	( )	For the same volumes, the effluent of complete mixed reactors has better quality than that of plug flow reactors.
4-	( )	The rotating biological contactors(RBC) is a combination of the activated sludge treatment process and the membrane filtration process.
5-	( )	The hydraulic losses in trickling filters system is bigger than that in activated sludge system.
6-	( )	The Membrane Bioreactor (MBR), bio-towers and trickling filters all are attached culture biological treatment systems.

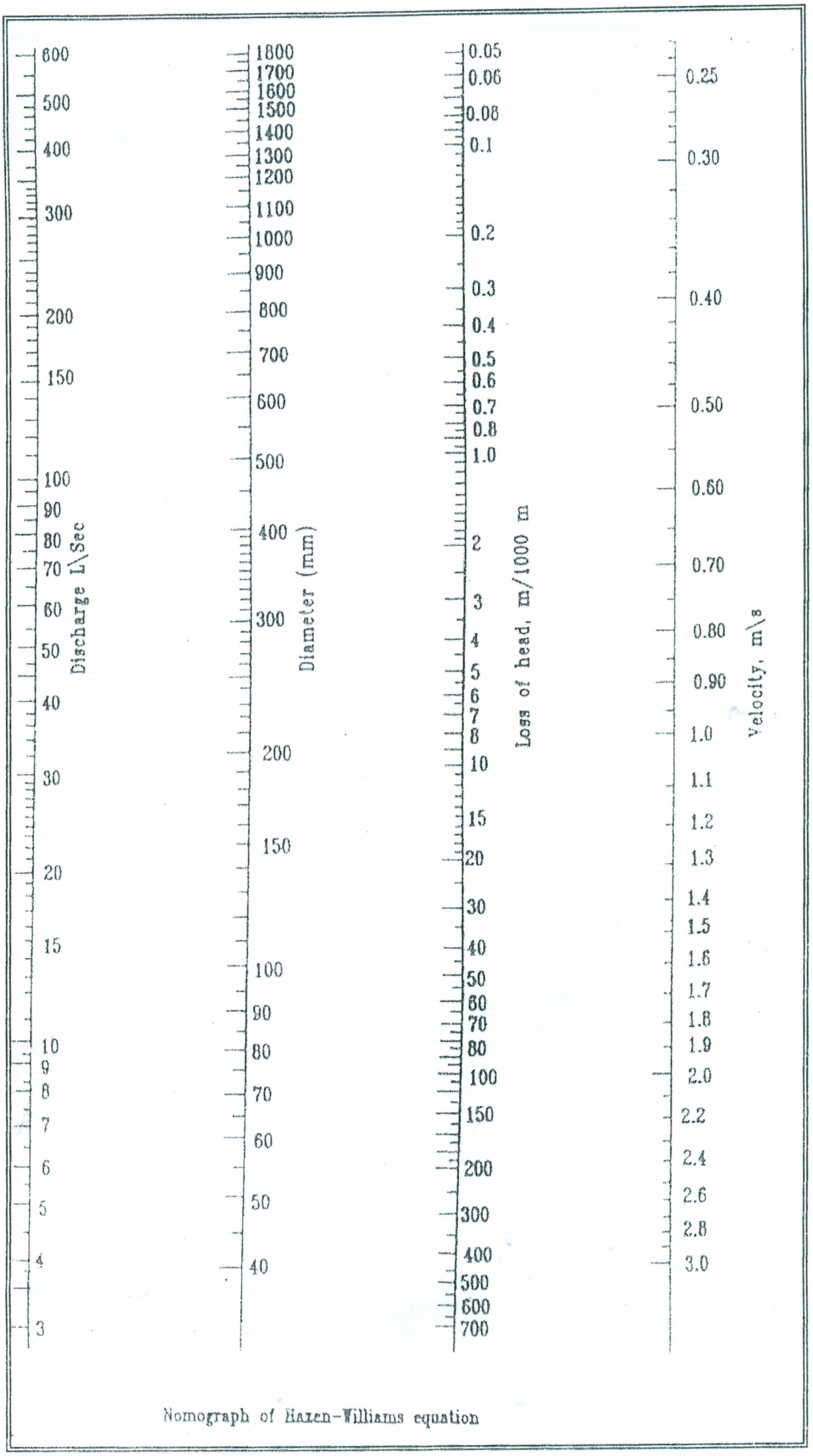
c) Design an activated sludge reactors to treat a waste flow of 25000 m^3/d with a BOD_5 of 220 mg/L after primary treatment. The effluent BOD_5 is to be less than 20 mg/l, assume X= 3500 mg/L, X_u =10000 mg/L , Y=0.5 , k_d = 0.07 d^{-1} , and F/M = 0.4kg BOD_5/kg MLSS Determine (7 marks):-
- The reactor volume.
- Mean cell residence time (day)
- The sludge wasting flow rate.
-The recirculation rate.

Hints: $X = \frac{\theta_c Y (S_0 - S)}{\theta (1 + k_d \theta_c)}$, $\theta = \frac{V}{Q}$, $\theta_c = \frac{VX}{Q_w X_r}$

Good luck , Assoc. Prof. Hisham El-Etriby, Assoc. Prof. Kamal Radwan



Nomograph for solution of Manning's equation for n = 0.013



Nomograph of Hazen-Williams equation