Faculty of Engineering

Department : Structural Engineering
Lecturer : Dr. Emad Elbeltagi
Course : Construction Project Management
Course Code : 8414
Total Marks : 70 **Class :** 4th Civil
Date : 5 Jan 2013 **Time allowed :** 3 hours

Final Exam

Question 1: (45 Marks)

The activities, predecessors, duration and budget cost of a given project are given in the opposite table. Assume that the indirect cost for this project is estimated as LE500/day and the cost of each activity is uniformly distributed over its duration.

Activity	Predecessors	Duration (weeks)	Budget cost (LE×1000)
A	-	4	52
B	A	10	60
C	A	2	18
D	C	6	54
E	B, D	15	150
F	B, D	4	24
G	F	3	27
H	B, D	2	16
I	E, G, H	1	24
J	I	3	57
K	E	2	22
L	J	1	8
M	K, L	2	18

a. Calculate the activities' ES, EF, LS, LF, TF and FF, and mark the critical path. (9 marks)

b. Draw the net cash flow curve and determine the maximum amount of cash needed to finance this project and when it is needed. Assume: mark up is 10%; the calculation period is 4 weeks; costs are paid immediately; the retainage is 10% from all payments till one half of the contract value; advanced payment is 10% and Owner's payment delay of invoices is one period. (12 marks)

c. Determine the scheduled timings of the activities so that the weekly cost of the contract will not exceed LE30,000. What is the total delay in the project duration? Without performing any further calculations, what is the critical path of the new schedule? (8 marks)

d. Consider the schedule presented in "a" above, the crashability and cost slope of the activites are presented in the opposte table. Activities not listed in the table can not be crashed. Find the optimum project duration (i.e., the project duration corresponding the the minimum project total cost). (9 marks)

Act.	Cost slope	Crash Time
E	LE 200	5
B	LE 300	3
D	LE 400	2
J	LE 800	1

e. Consider the schedule presented in "a" above, assume now that the project is under construction and at the beginning of week 15, the following information were obtained from site: activities A, C and D were completed; remaining duration of activity B is 2 weeks; activity E will not start until beginning of week 16; activity K omitted and duration of activity G is increased by 2 weeks. Update the project schedule and mark the critical path. Suggest how the contractor deals with this situation to achieve minimum increase in contract cost. (7 marks)

Question 2: (12 Marks)

No.	Activity	No.	Activity
1	Set up site	7	Central walls
2	Excavate clayey soil	8	Roof beams
3	Excavate rock soil	9	Roof slab
4	External walls	10	Fill surrounding embankment
5	Floor and column footing	11	Clean reservoir
6	Columns	12	Clean up site

a. A rectangular reservoir has concrete external and central dividing walls, floor slab and precast concrete roof beams and slabs supported on concrete columns. The lower part of the excavation is in hard rock which is overlain by clayey soil. External walls and central walls are to be constructed directly on the rock. The list of activities is presented in the opposite table. Determine the activities logical relationships. (6 marks)

b. What are the risks that may affect either the client or the contractor from loading of rates in bills of quantities? (3 marks)

c. Compare the use of a performance (final) bond with that of retention money in terms of the protection given to the client (owner). (3 marks)

Question 3: (13 Marks)

a. Briefly discuss, how the contractor could minimize the negative cash flow (deficit) in a given construction project. (2 marks)

b. Calculate the unit price per m^3 to excavate and transport 3000 m^3 of trench using a crew of 0.75 m^3 bucket-size excavator costing LE640/day (day = 8 hrs), an operator and labor at hourly rates of LE40 and LE30 respectively. The total transportation cost is assumed LE4500. Expected crew production rate is 50 m^3/hour. (4 marks)

c. What are the main duties (the role) of the owner in a construction project? (2 marks)

d. "A proper contract strategy for a project involves identifying three key decisions that achieve the project objectives" what are these decisions? (3 marks)

e. Suggest a suitable contract for the following projects, show the reason for your selection:

1. Maintenance project with un-defined work scope
2. Governmental school building (2 marks)

With my best wishes *Prof. Emad Elbeltagi*

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

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

---------- 5- 1 – 2013 - رابعة مدنى قديم ----------

Answer the following questions

Any data missing can be reasonably assumed

1-a) Discuss the conditions that should be considered when choosing the location and type of an intake of a city's water supply. (5 marks)

b) A city of population 250000 capita and average water consumption 220L/C/d has a navigable canal of width 40 ms with water level at (12.50), bed level (8.00), ground level (13.00) and road level at (15.00) feeding a water treatment plant. The road width is 20 ms with side slopes for canal 3 : 2 & 2 : 1 and the water level in rapid mixing tank is (20.00).

i- Choose and design a suitable type of intake you recommend.

ii- Design all components intake (conduit pipes, sump, low lift pump) if the pumps work 16 hours a day. (15 marks)

2-a) Define: i) Rapid mixing ii) Flocculation (5 marks)

b) For a proposed water purification plant of a daily capacity of 75000 m^3 it is required to determine the dimension of four clari-flocculator units. What would be the dimension of one unit if the plant operation period is 20 hr/day. If one of the four units is out of operation, determine the over flow rate and retention period in the remaining three units for a working period of 20 hr/day. (10 marks)

3- a) Classify the different types of filters according to:

i) direction of flow, ii) filter media, iii) filtration rate (3 marks)

b) What are The most common disinfectants used in the water supply systems ? (3 marks)

c) A water treatment plant produce 24000 m^3/d . The rapid sand filter unite has an area of 48 m^2 , its filtration rate is 7.0 m/hr, the water backwash rate is 32 $m^3/m^2/hr$ and the air backwash rate is 52 $m^3/m^2/hr$, determine the number of filter unites and design all the different filter pipes diameter . (6 marks)

Design velocity criteria of filter pipes

Pipe	Velocity (m/sec)	Pipe	Velocity (m/sec)
Inlet	0.3 – 0.8	Wash water supply	1.5 – 3
Outlet	1- 2	Wash water drain	0.9 – 2.0
Air supply	15 - 20	Preparing filter to waste	1.6 – 3.2

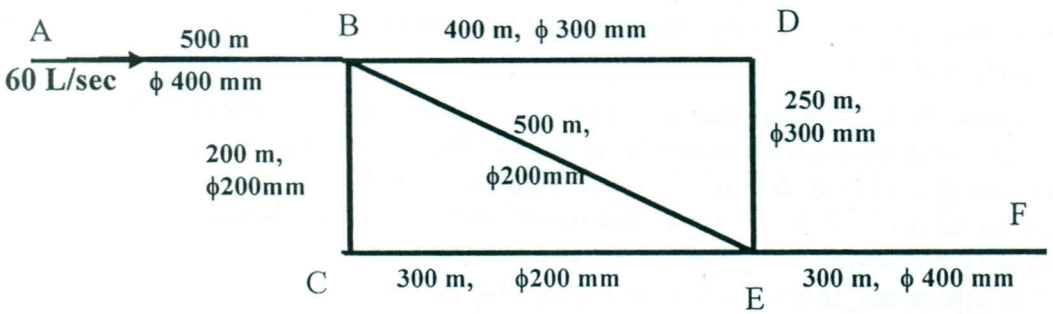
4-a) Draw the cross section elevation of balancing elevated tank showing all pipes and valves. (3 marks)

b) For a city of population 40000 capita and an average water consumption/capita/day = 200 lit, determine the amount of ground storage and elevated storage to be provided economically. Taking into consideration that the working hours of the low lift pumps are 24 hr/day and for the high lift pumps are 16 hr/day. The characteristics consumption data during the day are given as follows:- (6 marks)

Time	Rate L/2h	Time	Rate L/2h
12 M.N 2	3.0	12 N 2	30.0
2 - 4	6.0	2 - 4	28.0
4 - 6	8.0	4 - 6	26.0
6 - 8	14.0	6 - 8	14.0
8 - 10	26.0	8 - 10	8.0
10 - 12 N	32.0	10 - 12M. N	5.0

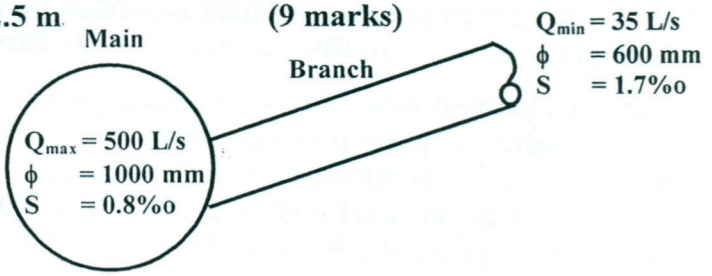
5-a) State the different types of pipes and valves used in water distribution systems. (3 marks)

b) In the pipe system shown (C=100), find the head losses from point (A) to point (F). (6 marks)



6-a) Write briefly the purpose of screen , grit chamber and primary sedimentation tank. (6 marks)

b) A main sewer collector of diameter 1000mm and slope of 0.8 ‰ carries Max. D.W.F 500 L/S and minimum flow 110 L/S. If a branch sewer Join with it with diameter 600mm and slope of 1.70 ‰ carries Max. D.W.F 150 L/S and minimum flow 35 L/S. At what height above the invert level of the main collector should the branch enter there will be no backing up of sewage. Determine also the diameter of pumping station to meet the Max. D.W.F of the main sewer if θ=10min. and d = 2.5 m (9 marks)



c) Design the following treatment units in sewage treatment plant :

i) Grit chamber ii) Primary sed. tanks

Given the follwing data: Q_{ave} = 45000 m^3/d and Q_{max} = 80000 m^3/d. Over flow rate of grit chamber = 1100 $m^3/m^2/d$. Over flow rate of primary sed. tank at max. and average flows are 80 and 30 $m^3/m^2/d$ respectively, and the max. Diameter of tank is 30m . (10 marks)

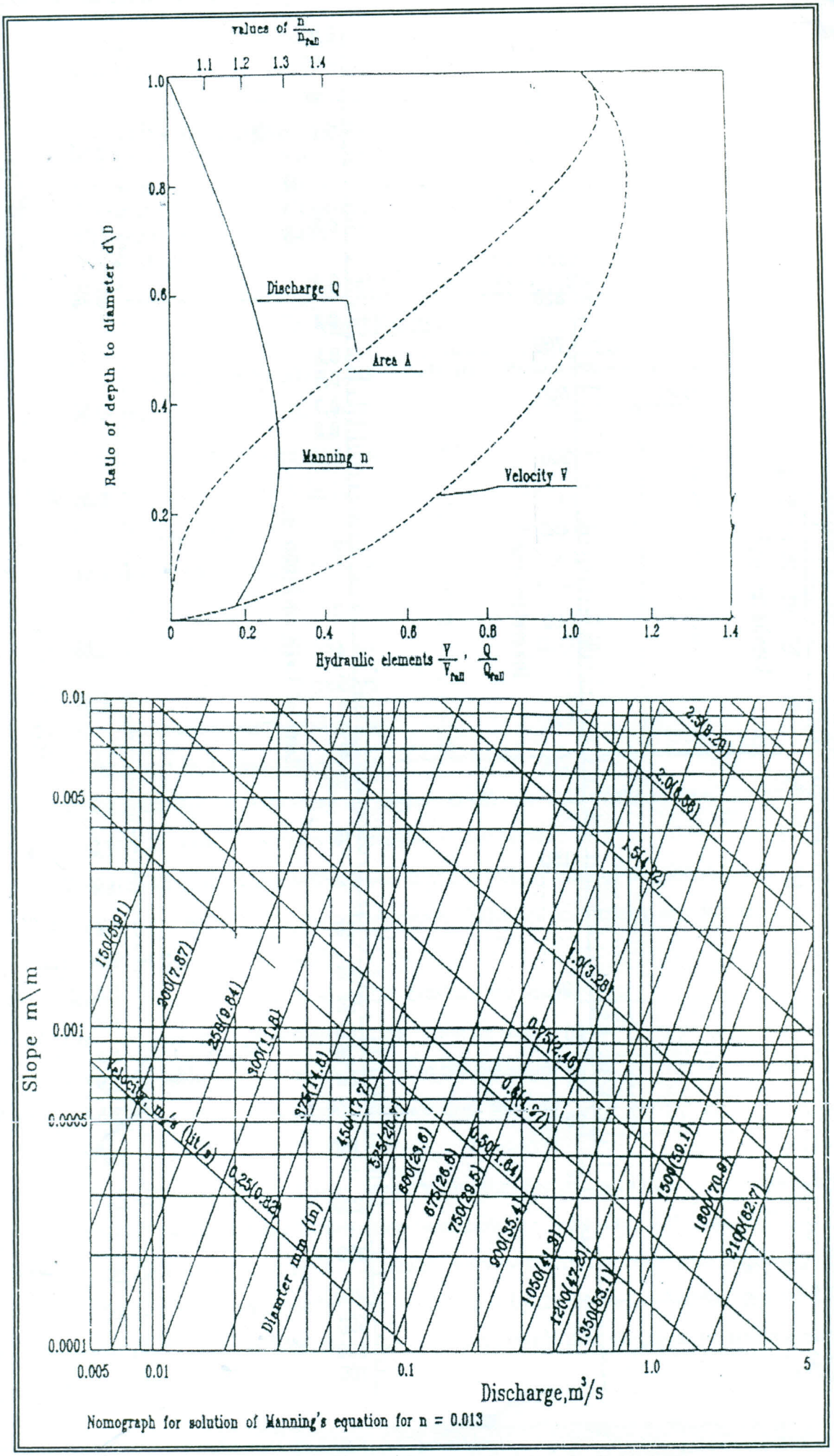
7-a) Draw the biomass and food utilization curve showing each phase. (6 marks)

b) Explain using sketches the purpose of the recirculation line in suspended culture and in attached culture biological treatment processes. (6 marks)

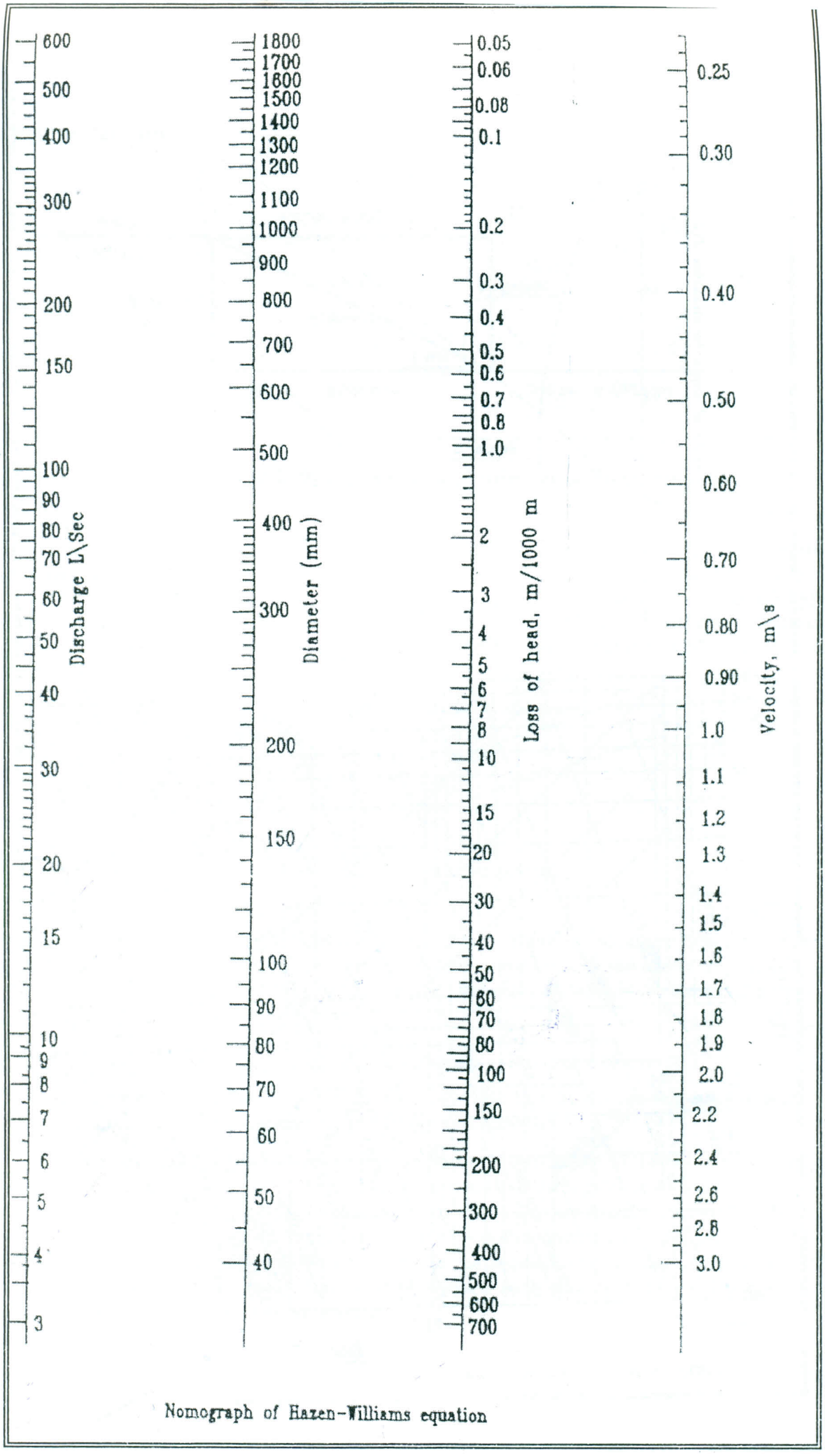
c) An activated sludge system is to be used for secondary treatment of 15000 m^3/d . The BOD is 220 mg/lit, and it is desired to have not more than 10 mg/lit of soluble BOD in the effluent. A pilot-plant analysis has established the following kinetic values: Y = 0.5 kg/kg, k_d = 0.05 d^{-1}, θ_c = 10 d. Assuming an MLSS concentration of 3000 mg/lit and an underflow concentration of 8000 mg/lit from the secondary clarifier, determine : (1) the reactor volume, (2) solids that must be wasted each day , (3) the recycle ratio, and (4) the organic loading rate. (8 marks)

Hints:

$$X = \frac{\theta_c Y (S_0 - S)}{\theta (1 + k_d \theta_c)}$$



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



Nomograph of Hazen-Williams equation