



Course no :

Student No:

Course Title:

Student Name:

**Sanitary Engineering**

**Final Exam  
Theoretical Exam**

**Exam Time: 2.5 Hours**

**2<sup>nd</sup> Semester 2012-2013**

**Date: 22/05/2013 12:00**

**Questions: Three**

**Total Grade: 60**

**Answer All Questions**

**Open Book: No**

**Using Computer: No**

**Using Calculator: yes**

**First Question**

**Don't forget, manage your time!!!**

**(30/60)**

**1.1 Discus the following terms:**

Wheel load diagram      Gas regime effect      pipe corrosion      hydraulic radius

**1.2 Answer the following question:**

- Explain the water cycle in details?
- What are the main criteria to choose the kind of collection system, Discus?
- What are the main kinds of pipe materials and the Factors effecting the selection of them?
- Why manholes are important? Explain the main criteria to estimate the distance between them?
- Account the important factors that control run off?
- What are the important hydrodynamic considerations in sewer design? Explain?
- Explain the phenomena Water hammer in pipe collection system? How can man prevent it?
- Explain the energetic aspect in the processing of evaporation and condensation?
- What are the Impacts of Storm water on waste water treatment processes? Discus?
- Account the main steps of Decision making? Explain shortly?

**Second Question**

**(30/60)**

- 1) Use the nomogram and partial flow curves to design two pipes, use the data in the table (16 pts)

Pipe	$Q_p[m^3/s]$	$d/D[-]$	$V[m/s]$
1	0.2	0.35	1.0
2	0.6	0.85	4.0

- Find the diameter and the slope of each pipes required, if  $n= 0.04$ .
- Find the kind of flow, assume fully flow,  $\rho = 1100 \text{ kg/m}^3$ ,  $\nu = 0.5\text{Ns/m}^2$
- Calculate the truck load on each pipe if the backfill cover is 1.1 m, the Impact factor is 1.0.
- Prove the hydrodynamic validity for both cases and Suggest possible solutions if need?  
Explain your Results and Decisions you make?

- 2) The population number in a municipality is 720000 inhabitants, (7 pts)  
Design a wastewater pump station to lead the wastewater in the collection system,  
Consider the wet part = 60% and the water demand of 80l/c.d. Express the dimension of rising and transport pipe in inch.

- 3) For flow rate  $18000 \text{ m}^3/a$  in a pipe line  $L= 1.4 \text{ km}$ , (7 pts)  
Find the needed amount of  $\text{NaNO}_3$  to prevent Corrosion, Consider  
The flowed medium is domestic waste water with a  $C_{\text{IC}} = 50 \text{ mg/l}$  and  $C_{\text{TC}} = 450 \text{ mg/l}$ .  
Take decision for all logic assumptions you need.

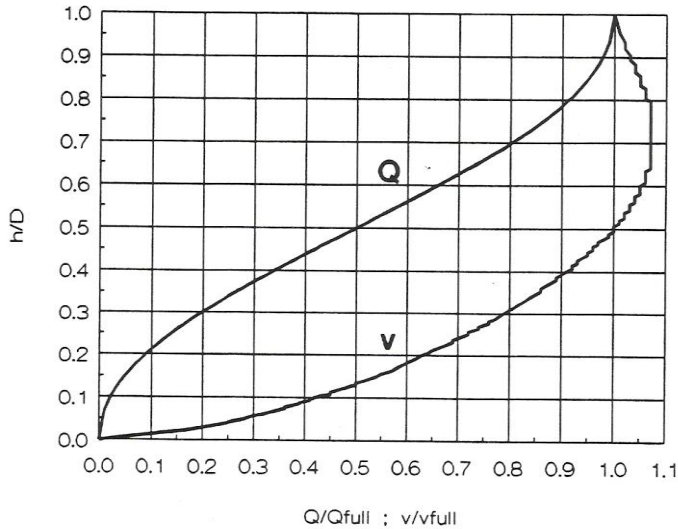
**End of Questions  
Good Luck**



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Pipe Diameter, millimetres	Height of Free H Above Pipe (metres)									
	0.15	0.20	0.46	0.61	0.76	0.91	1.07	1.22	1.52	1.83
305	70.8	39.9	22.5	13.9	8.4	5.3	4.6	3.5	2.5	0.7
381	86.4	48.5	27.3	17.0	10.2	6.4	5.2	4.2	3.0	0.8
457		57.3	32.1	20.0	12.0	7.6	6.6	5.0	3.5	1.0
533		65.7	36.9	23.1	13.9	8.7	7.6	5.7	4.1	1.1
610			41.7	26.1	15.7	9.9	8.6	6.5	4.6	1.3
686			45.2	29.2	17.5	11.1	9.6	7.2	5.2	1.4
762				32.2	19.4	12.2	10.7	8.0	5.7	1.6
838				34.6	21.2	13.4	11.7	8.7	6.2	1.7
914					23.1	14.5	12.7	9.5	6.8	1.9
1067					24.5	16.9	14.7	11.0	7.8	2.1
1219						17.8	16.7	12.5	8.9	2.5
1372							17.3	14.0	10.0	2.7
1524								14.5	11.1	3.0
1676									12.1	3.3
1829									12.5	3.6
1981										3.9
2134										4.0

Source: Concrete Pipe Design Manual, American Concrete Pipe Association, SI units by author

