



Course no :

Student No:

Course Title:

Student Name:

Sanitary Engineering

**Final Exam
Theoretical Exam**

Exam Time: 2.5 Hours

2nd Semester 2010-2011

Date: 26/05/2010 11:00

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!!!

(10/60)

Describe the following phenomena:

- Hydraulic Radius
- Dispersing
- Backfill coefficient
- Drop Manhole
- Pipe corrosion

Second Question

(22/60)

Answer the following questions

1. Compare between drink, Storm and waste water by Completion the table

(3 pt)

Parameter	Drink water	Storm water	Waste water	unit
pH				
Nitrate (NO ₃)				
Suspended Solid				
Color				
Ammonia (NH ₄)				

2. What are the main reasons of increasing of water demand, how can you face this Problem? **(2 pt)**
3. By the estimation of Run Off coefficient we use the higher value, when? Why? **(2 pt)**
4. Show the Sewage flow diagram for 24 hours (**quantitative**)? Explain shortly **(2 pt)**
5. Why the Velocity is an important consideration in sewer design? Explain? **(2 pt)**
6. Show the Wheel load distribution diagram on buried pipes? Explain? **(2 pt)**
7. Explain the effect of the following terms on the selection of pipe Material
Internal pressure, tension and thermal Stress? **(3 pt)**
8. Account the Methods to prevent the corrosion in pipe systems? Explain the cheapest one? **(2 pt)**
9. What are the main Impact of storm water on the WWTP - processing? **(2 pt)**
10. Account the main steps of Decision making? Explain shortly **(2 pt)**



Third Question

(28/60)

1) Given are the following data for gravity pipe serving in a community of 600.000 inhabitants (8 pts)

Pipe length	50 km
Q_{avg}	5 l/c.h
Infiltration rate	1000 l/km.h
Inflow	600 l/s

The waste water production rate is 80% of the water supply.

- Find Q_{max} , Q_{des} and Q_{min}
- Find the pipe dimension and the Velocities? Given: $S = 1.5\%$, $n = 0.03$
- Discuss, your Results?

2) Use the nomogram and partial flow curves to design two pipes, use the data in the table (10 pts)

Pipe	$Q_p [m^3/h]$	$d/D [-]$	$V [m/s]$
1	900	0.4	1.0
2	2700	0.9	2.0

- Find the diameter and the slope of each pipes required, if $n = 0.02$.
- Find the kind of flow, assume fully flow, $\rho = 1050 \text{ kg/m}^3$, $\nu = 0,38 \text{Ns/m}^2$
- Calculate the truck load on each pipe if the backfill cover is 0.9 m, the Impact factor is 1.1.

3) The population number in a municipality is 150000 inhabitants, (5 pts)

Design a wastewater pump station to lead the wastewater in the collection system,

Consider the wet part = 60% and the water demand of 120l/c.d. Express the dimension of rising and transport pipe in inch.

4) For flow rate $2500 \text{ m}^3 / \text{d}$ in a pipe line $L = 1.8 \text{ km}$, (5 pts)

Find the needed amount of NaNO_3 to prevent Corrosion, Consider

The flowed medium is domestic inorganic Waste water with a $C_{IC} = 50 \text{ mg/l}$ and $C_{TOC} = 400 \text{ mg/l}$.

Take decision for all logic assumptions you need.

End of Questions
Good Luck