Course no :		Student No:
Course Title:	**Midterm Exam**	Student Name:
Sanitary Engineering	**Theoretical Exam**	_____

Exam Time: 1.5 Hours	2nd **Semester 2010-2011**	**Date: 31/03/2011 09:30**
Questions: Two	**Total Grade: 20**	**Answer All Questions**
Open Book: No	**Using Computer: No**	**Using Calculator: yes**

First Question   <u>Don't forget, manage your time!!!</u>   **(8/20)**

Answer the following questions

1. State the types of Collection systems? Explain the advantages and the disadvantages?   **(1.5 pts)**
   What is the main criteria to choose the kind of collection system, discus?
2. Show the IDF curve, discus in details?   **(0.5 pt)**
3. Account the Methods for the Run off estimation? Explain the difference between them?   **(1.5 pt)**
   Account the important factors that control Run off?
4. Why the Velocity is an important consideration in sewer design? Explain?   **(1 pt)**
5. Discus Superficial loads on buried pipes?   **(1 pt)**
6. Explain the phenomena Water hammer in pipe collection system?   **(1 pt)**
7. Explain the effect of the following terms on the selection of pipe Material
   Internal pressure, tension and thermal Stress?   **(1.5 pts)**

Second Question   **(12/60)**

a). in the municipality of Northern of Gaza, the actual population is 360.000 Inhabitants   **(3 pts)**
and the Growth Rate = 3.5 [%]
   i)   Use the predicted population method to estimate the Population number for 2025.
   ii) Find the waste water rate flow Q if the water demand is 60 l/c.d.
   iii) Find the rate of flow Q for the design of WWTP, explain your opinion?

b). given are the following data for gravity pipe serving in a community of 250.000 inhabitants   **(4 pts)**
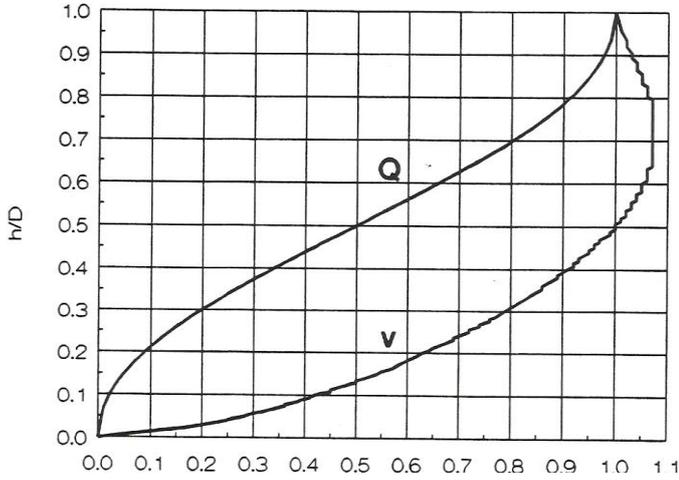
Pipe length	12 km
Q_{avg}	4 L/c.h
Infiltration rate	2.1 m^3/km.h
Inflow	0.111 m^3/s

The waste water production rate is 80% of the water supply.
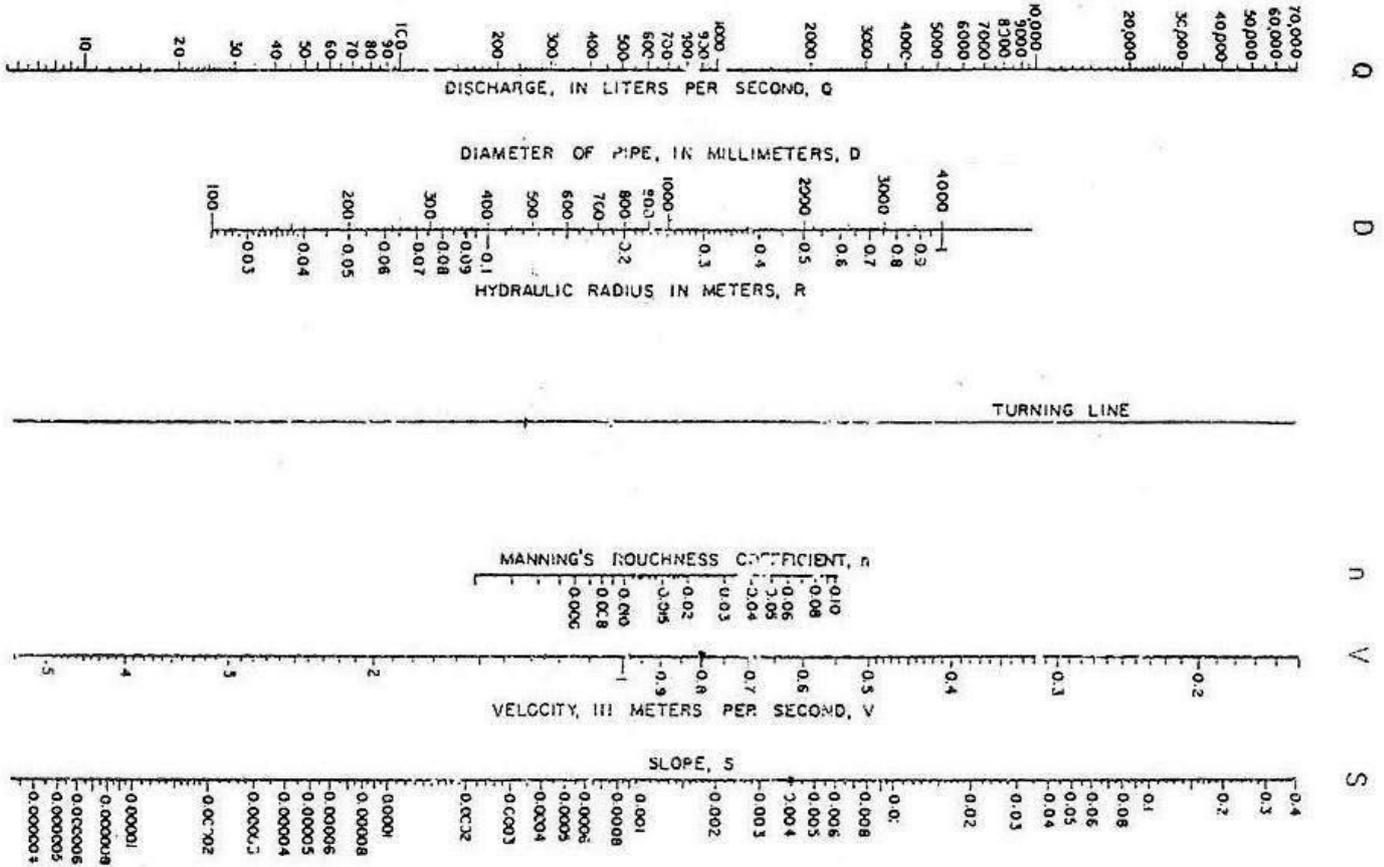   i) Find Q_{max}, Q_{des} and Q_{min}
   ii) Find the pipe dimension and the Velocities? Given: S = 1.5%, n= 0.02

c). Use the Nomogram and partial flow curves to design two pipes, use the data in the table   **(5 pts)**

Pipe	**$Q_p[m^3/s]$**	**d/D[-]**	**V[m/s]**
1	0.2	0.4	1.5
3	0.8	0.9	1.8

   i)   Find the diameter and the slope of each pipes required, if n= 0.03.
   ii) Find the kind of flow, assume fully flow, ρ = 900 kg/m^3, ν = 0,32Ns/m^2
   iii) Calculate the truck load on each pipe if the backfill cover is 1.1 m. Use an Impact factor 1.0.

		Height of Fill 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	305
381	86.4	48.5	27.3	17.0	10.2	6.4	5.2	4.2	3.0	0.8	381
457		57.3	32.1	20.0	12.0	7.6	6.6	5.0	3.5	1.0	457
533		65.7	36.9	23.1	13.9	8.7	7.6	5.7	4.1	1.1	533
610			41.7	26.1	15.7	9.9	8.6	6.5	4.6	1.3	610
686			45.2	29.2	17.5	11.1	9.6	7.2	5.2	1.4	686
762				32.2	19.4	12.2	10.7	8.0	5.7	1.6	762
838				34.6	21.2	13.4	11.7	8.7	6.2	1.7	838
914					23.1	14.5	12.7	9.5	6.8	1.9	914
1 067					24.5	16.9	14.7	11.0	7.8	2.1	1 067
1 219						17.8	16.7	12.5	8.9	2.5	1 219
1 372							17.3	14.0	10.0	2.7	1 372
1 524								14.5	11.1	3.0	1 524
1 676									12.1	3.3	1 676
1 829									12.5	3.6	1 829
1 981										3.9	1 981
2 134										4.0	2 134

Pipe Diameter, millimetres

DISCHARGE, IN LITERS PER SECOND, Q

DIAMETER OF PIPE, IN MILLIMETERS, D

HYDRAULIC RADIUS IN METERS, R

TURNING LINE

MANNING'S ROUGHNESS COEFFICIENT, n

VELOCITY, IN METERS PER SECOND, V

SLOPE, S