



Course no :

Student No:

Course Title:

**Midterm Exam**

Student Name:

**Sanitary Engineering**

**Theoretical Exam**

**Exam Time: 1.5 Hours**

**2<sup>nd</sup> Semester 2011-2012**

**Date: 24/03/2012 13:00**

**Questions: Two**

**Total Grade: 20**

**Answer All Questions**

**Open Book: No**

**Using Computer: No**

**Using Calculator: yes**

**First Question**

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

**(9/20)**

**Answer the following questions**

1. What are the main fields of sanitary engineering? Describe in details? **(1 pt)**
2. Explain the hydrological cycle in details? **(1 pt)**
3. Define the hydraulic radius? Explain? **(1 pt)**
4. State the types of Collection systems? Explain the advantages and the disadvantages? **(1.5 pt)**  
What is the main criteria to choose the kind of collection system, discuss?
5. Account the Methods for the Run off estimation? Explain the difference between them? **(1.5 pt)**  
Account the important factors that control Run off?
6. Why the Velocity is an important consideration in sewer design? Explain? **(1 pt)**
7. Explain the phenomena Water hammer in pipe collection system? **(1 pt)**
8. Account the Techniques of Storm water Reuse? Discuss the advantages and Disadvantages of Water reuse? **(1pts)**

**Second Question**

**(11/20)**

- a). in the municipality of Northern of Gaza, the actual population is 300.000 Inhabitants **(3 pts)**  
and the Growth Rate = 4 [%]
- i) Use the predicted population method to estimate the Population number for 2030.
  - ii) Find the waste water rate flow Q if the water demand is 70 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 560.000 inhabitants **(4 pts)**

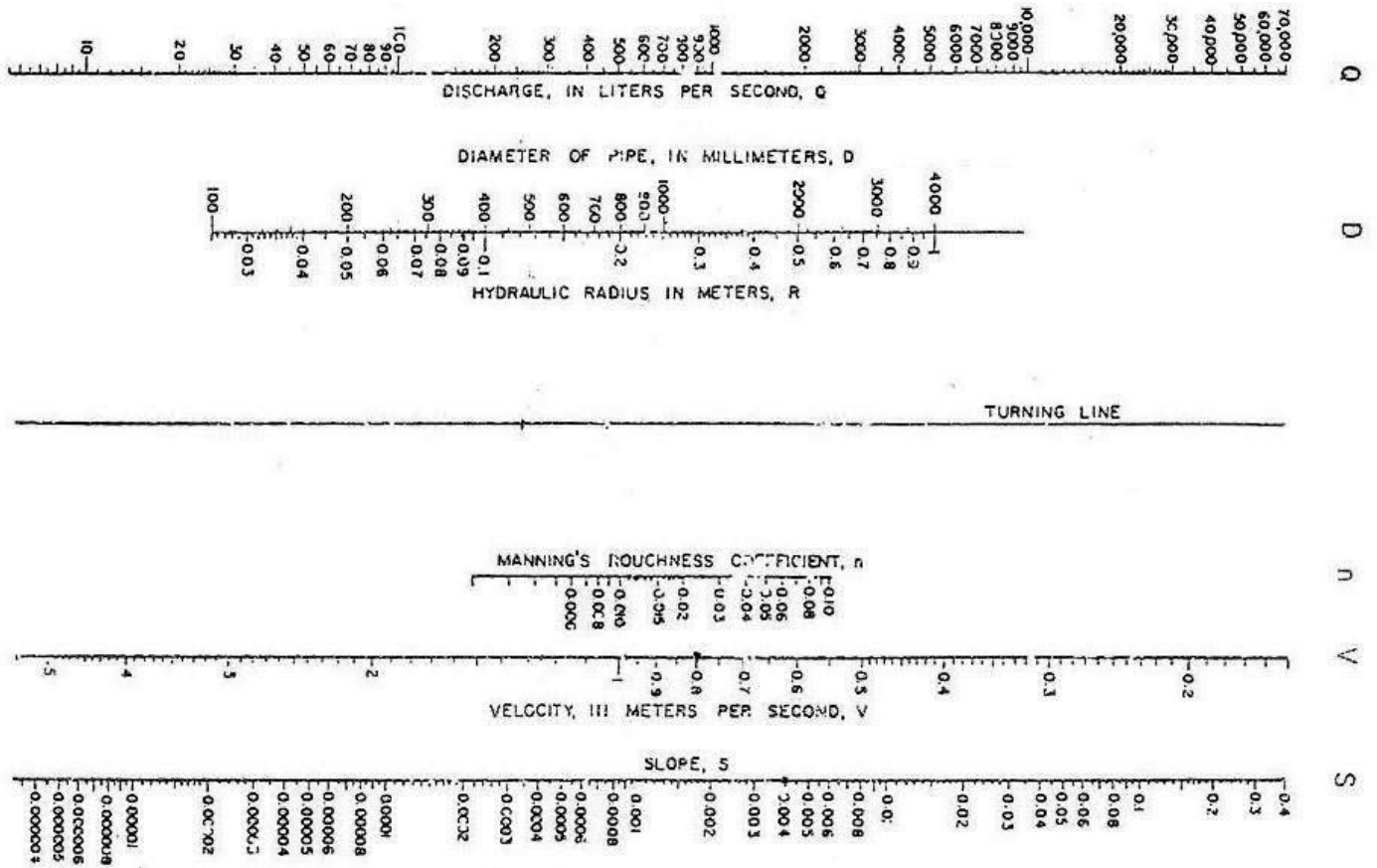
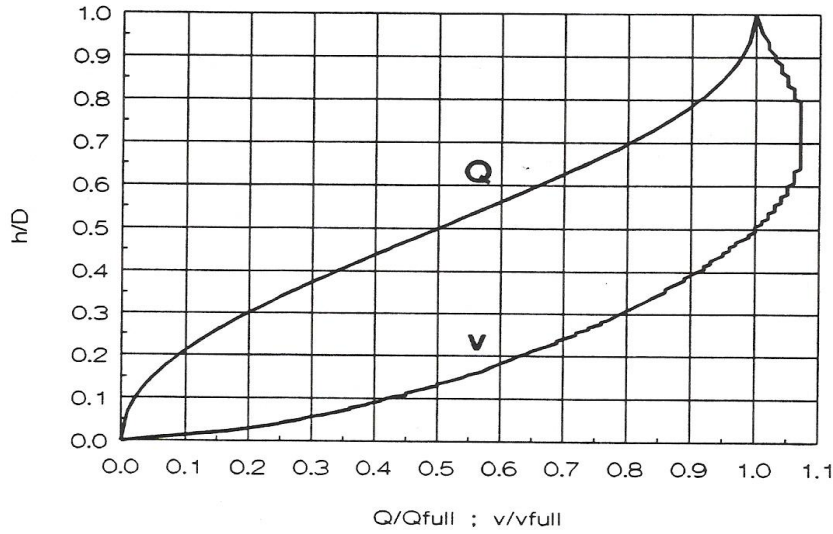
Pipe length	15 km
$Q_{avg}$	3.5 L/c.h
Infiltration rate	3.33 m <sup>3</sup> /km.h
Inflow	0.014 m <sup>3</sup> /s

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:  $S = 1.5\%$ ,  $n = 0.02$
  - iii) Discuss your results in details?
- c). Use the Nomogram and partial flow curves to design two pipes, use the data in the table **(4 pts)**

Pipe	$Q_p$ [m <sup>3</sup> /s]	d/D [-]	V [m/s]
1	0.22	0.3	1.5
3	0.85	0.8	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,  $\rho = 900 \text{ kg/m}^3$ ,  $\nu = 0.32 \text{Ns/m}^2$
- iii) Discuss your results in details?



End of Questions  
Good Luck