



Course no :

Student No:

Course Title:

**Midterm Exam**

Student Name:

**Sanitary Engineering**

**Theoretical Exam**

**Exam Time: 1.5 Hours**

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

**Date: 24/03/2012 11:00**

**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!!!**

**(10/20)**

**Answer the following questions**

1. Define the following terms: (2 pt)  
Infiltration      Gas regime      Pipe Corrosion      IDF curve
2. What are the main fields of sanitary engineering? Describe in details? (1 pt)
3. Explain the hydrological cycle in details? (1 pt)
4. State the types of Collection systems? Explain the advantages and the disadvantages? (1 pt)  
What is the main criteria to choose the kind of collection system, discuss?
5. Define the hydraulic radius? Explain? (1 pt)
6. Account the important factors that control Run off? (1 pt)
7. What are the important hydrodynamic considerations in sewer design? Explain? (1 pt)
8. Explain the phenomena Water hammer in pipe collection system? (1 pt)
9. Explain the energetic aspect in the processing of evaporation and condensation? (1 pt)

**Second Question**

**(10/20)**

- a). in the municipality of Northern of Gaza, the actual population is 1000.000 Inhabitants (3 pts)  
and the Growth Rate = 3.5 [%]
- 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 100 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 (3 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:  $S = 1.5\%$ ,  $n = 0.02$
- 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    |

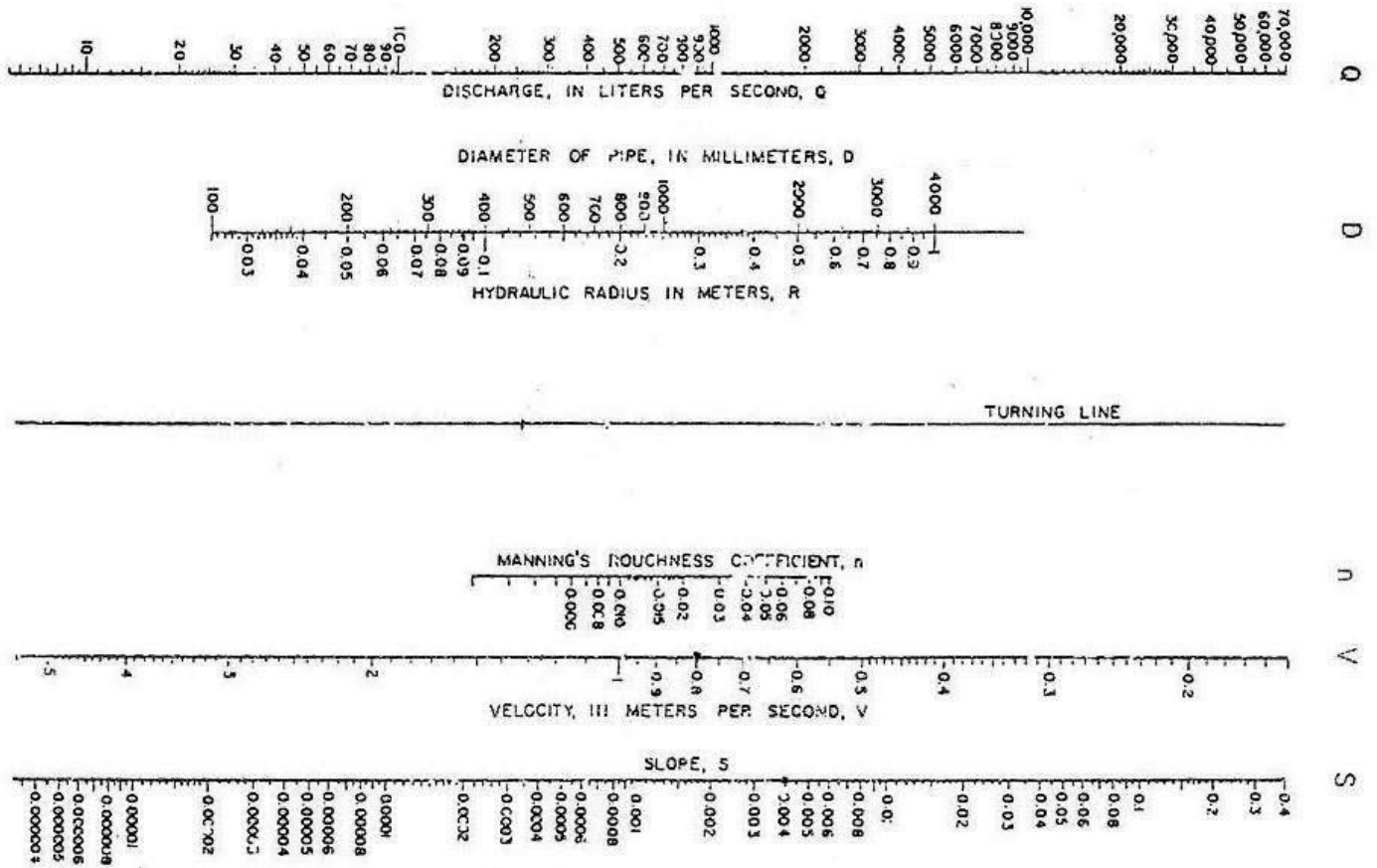
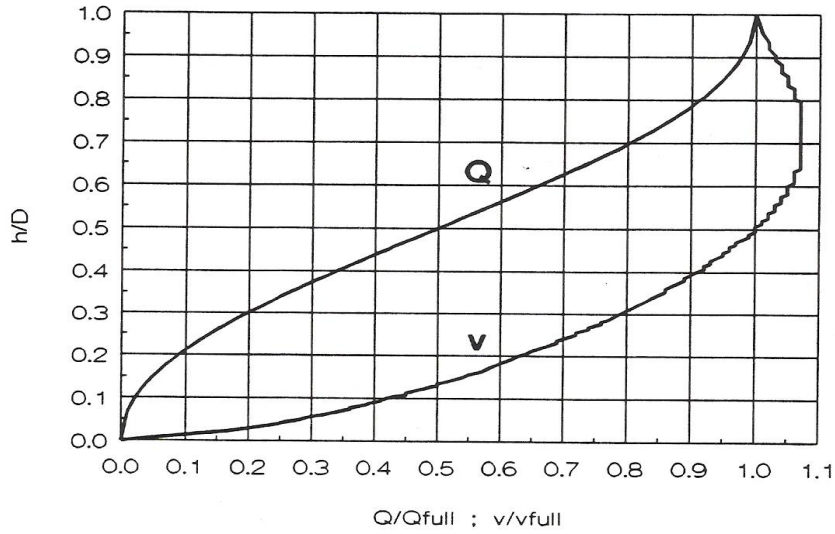
- i) Find the diameter and the slope of each pipes required, if  $n = 0.03$ .
- ii) Find the kind of flow, assume fully flow,  $\rho = 900 \text{ kg/m}^3$ ,  $\nu = 0,32 \text{Ns/m}^2$



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**End of Questions**  
**Good Luck**