Kafrelsheikh University
Faculty of Engineering
Dept. Mech. Engineering
Year: 4th year
Subject: Pipelines and Networks
Code: MEP4120

Semester: 1st Semester
Final Examination
Date: January 9th, 2020
Time allowed: 3 hours
Full Mark: 60

1. No. of pages: 3 - No. of questions: 4.
2. Pipelines tables are allowed.
3. Clear solutions are required. Marks will not be assigned for answers that require unreasonable effort for the instructor to decipher.
4. Ask for clarification if any question statement is unclear to you.
5. The weight of each problem is indicated

Question #1: **(15 marks)**

A)Complete the following sentences:

1. Energy grade line and hydraulic grade line can be obtained by …….. and ……., respectively.
2. If a valve is installed in a network, when the valve is being closed, the head loss through the valve ……
3. The sudden contraction in pipes causes a marked drop in pressure due to…….. and……..
4. Most flow meter manufacturers recommend installing their flow meter at least 10 ro 20 pipe diameters downstream of any elbows or valves because ……..
5. In natural gas networks, the distribution pressures are classified into…… , ……., and…….

B)Prove that for laminar flow of a newtonian fluid through a circular pipe, the flow rate (Q) can be obtained from this relation:

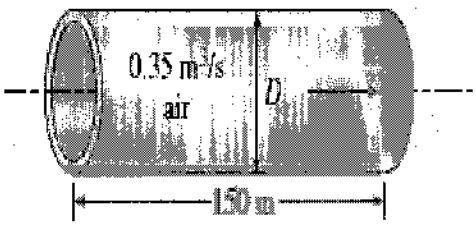
$$Q = \frac{\pi D^4 \Delta P}{128 \mu L}$$ (Poiseuilli's law)

Question #2: (15 marks)

A) For the flow through a pipe, Prove that the friction coefficient (f) between the fluid and the pipe depends on the Reynolds number (Re) and the relative roughness ($\frac{\epsilon}{D}$).

$$\mathbf{f = fn(Re, \frac{\epsilon}{D})}$$

B) Heated air at 1 atm and 50°C is to be transported in a 150-m-long circular plastic duct at a rate of 0.35 m^3/s. If the head loss in the pipe is not to exceed 20 m, determine the minimum diameter of the duct. If the duct length is doubled while its diameter and the total head loss through it are maintained constant, determine the drop in the flow rate through the duct.

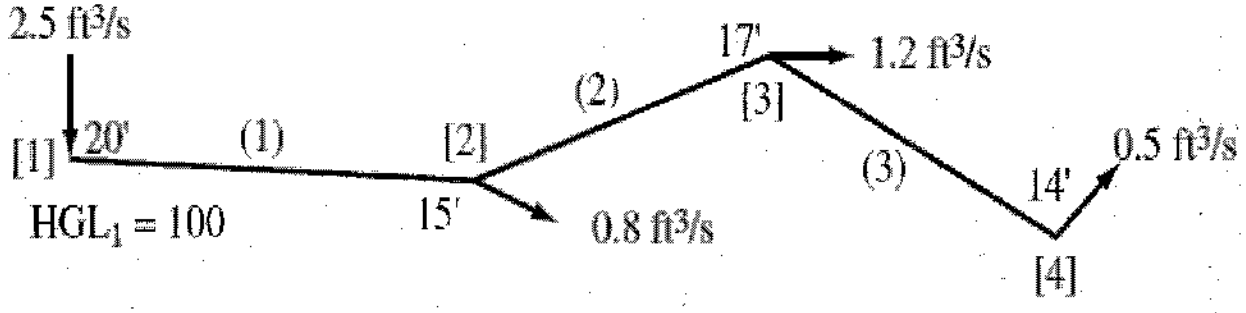


Question #3: (15 marks)

A) Define (Fixed grade junction, Junction, real loop, and pseudo loop)

B) The coefficients K and n for the exponential formula are given in the table for each of the three pipes in this branched system. **Find** the discharge in each pipe and the pressure at each node. The elevation of the HGL at node 1 is H1 = 100 ft.

Pipe	K	n
1	3.772	1.944
2	5.730	1.926
3	16.29	1.889



Question #4: (15 marks)

A) What is the difference between the pressure-reducing valve and the back-pressure valve?

B) For the nine pipes and six nodes networks shown in the next figure, **write** the system of:

- Q-equations,
- H-equations, and
- ΔQ equations.

Note that the shown table gives three points on the pump performance curve.

Q ft^3/s	Head ft.
1.0	60
1.5	55
2.0	48