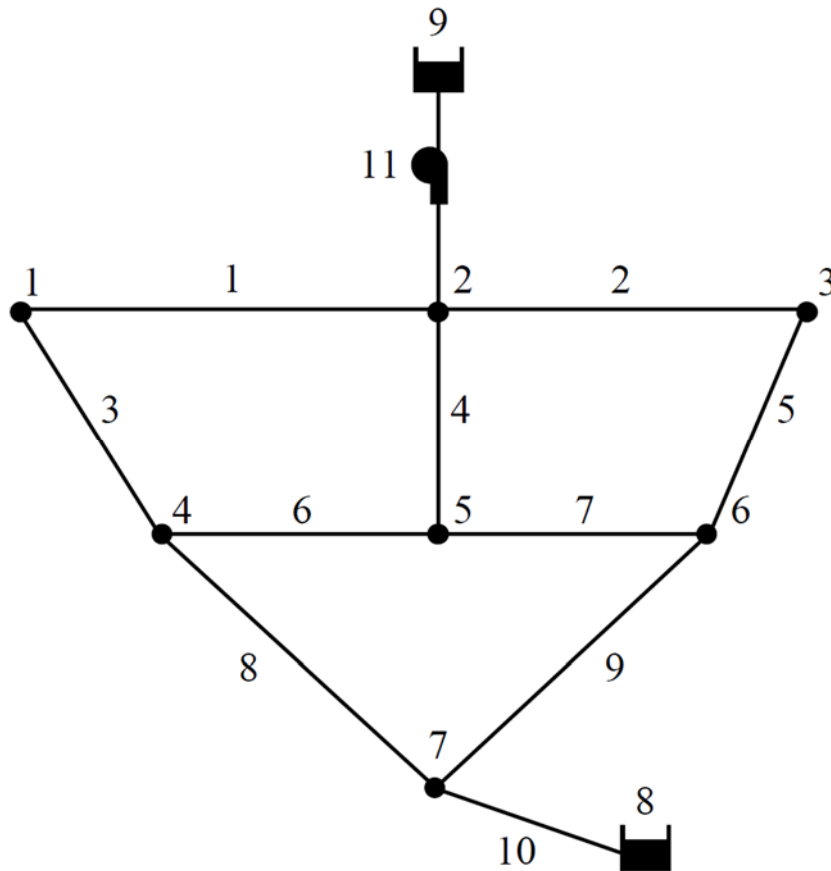


Florida International University
Department of Civil and Environmental Engineering
CGN5930: Unsteady Flows in Rivers and Pipe Networks
Instructor: Arturo S. Leon, PhD, PE, D.WRE

Homework 4/Mini Project 4, Spring 2019

Name of Student: _____ **Due Date:** 04/17/2019

1. For the pipe network shown below, determine the flow rates in all pipes and the pressure heads at all nodes. The data for the pipes, junctions (and flow demands at nodes) and pump are presented in Tables 1, 2, and 3, respectively.



Link ID	Upst. Node	Downst. Node	L (m)	D (mm)	e (mm)
Pipe 1	1	2	1000	300	1.5
Pipe 2	2	3	1000	300	1.5
Pipe 3	1	4	1000	250	1.5
Pipe 4	2	5	1000	300	1.5
Pipe 5	3	6	1000	250	1.5
Pipe 6	4	5	1000	250	1.5
Pipe 7	5	6	1000	250	1.5
Pipe 8	4	7	1000	300	1.5
Pipe 9	7	6	1000	250	1.5
Pipe 10	7	8	1000	400	1.5
Pump 11	9	2			

Table 1: Pipe data for problem 4

Node ID	Elevation (m)	Demand (m ³ /hr)
Junc 1	80	450
Junc 2	80	150
Junc 3	75	375
Junc 4	100	187.5
Junc 5	80	750
Junc 6	80	187.5
Junc 7	150	187.5
Resvr 8	210	
Resvr 9	10	

Table 2: Junction and demand data for problem 4

Pump Head (m)	Pump Flow (m ³ /h)
240	0
180	500
0	1000
$h_p = 240 - 0.00024 Q^2$	

Table 3: Pump curve data for problem 4

2. A 2,400-ft-long, 2-ft-diameter pipeline conveys water from a hilltop reservoir to an industrial site. The pipe is made of ductile iron, has an outside diameter of 2.25 ft, and has expansion joints. The flow rate is 30 cfs. Determine the maximum water hammer pressure (in psi) that is likely to occur if the downstream flow valve is closed in 1.05 seconds. Also, determine the water hammer reduction (in psi) if a diverter is added that reduces the flow rate from 30 cfs to 10 cfs almost instantly on valve closure.
3. A 0.5-m-diameter concrete pipe (5.0 cm wall thickness with rigid pipe walls) carries water 600 m before discharging it into another reservoir. The surface elevation of the downstream reservoir is 55 m lower than the supply reservoir. A gate valve just upstream of the lower reservoir controls the flow rate. If the valve is closed in 0.65s, what is the maximum water hammer pressure?
4. A pipeline is being designed to withstand a total maximum pressure of 2.13×10^6 N/m². The 20-cm pipeline is ductile iron and conveys water at 40 L/s. Determine the required thickness of the pipe wall if the operational head on the pipeline is 40 m and also subject to water hammer if the flow control valve on the downstream end is closed suddenly. Assume that the longitudinal stresses will be negligible when the pipe is installed.