UNIVERSITY OF CALIFORNIA, DAVIS
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

COURSE: ENGINEERING HYDRAULICS (ECI 141)
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HOMEWORK 2: TURBULENT FLOW IN PIPES, LOCAL LOSSES, PIPES IN SERIES AND PARALLEL, THREE RESERVOIR PROBLEM.

Assigned: Saturday, January 27, 2018
Due: Thursday, February 8, 2018

PROBLEM 7

A concrete pipe main for a large neighborhood of a major US city provides potable water to about a million people.

a) Compute the volume flow rate (discharge) of water transported in the pipe when the head loss between points separated by L=3350 m is 6 m. The pipe has a diameter D=2.3 m and a roughness height of 5 mm. You may use either the *Direct Solution* or the *Iterative Solution*. In the latter case, use the Moody chart provided with these pages. Which regime is the flow in?

b) Compute Manning's n, Chezy C and Darcy-Weisbach's f.

c) Calculate also the input power to the pump require equired to convey the water (assume pump efficiency of 70%).

PROBLEM 8

Please solve problem P6.102 from the book. Please discuss the solution.
Hints for the solution: The values of K, the coefficient for minor losses, may be taken as follows: K_{entry}=1.0, K_{elbow}=0.41, $K_{gate\ valve}$ =0.16, $K_{sharp\ exit}$ =1.0, $K_{6\text{-}degree\ conical\ diffuser}$ =0.3. For galvanized iron, take a roughness height of 0.0005 ft.
Answer: Without=5.55 hp; with=5.31 hp.

PROBLEM 9

Please solve problem P6.78 from the book.
Hint for the solution: For commercial steel, take a roughness height of 0.046 mm. *Answer:* The flow is to the left. Q=25 m^3/h.

PROBLEM 10

Three ***smooth*** pipes with diameter D=10 cm and lengths L_1=200 m, L_2=400 m, L_3=800 m are laid in parallel and are supplied by water at a rate of 0.06 m^3/s. Please determine: a) The flow rate in each pipe; b) the pressure drop across the system. Please start the iterations with a value of the friction factor equal to 0.02 for the three pipes.
Answer: 0.028 m^3/s, 0.019 m^3/s, 0.013 m^3/s, 0.165 MPa.

PROBLEM 11

Compare the treatments for the case of flow at a junction (three-reservoir problem) found in the book (White, 2011), and in the book by Munson et al. (hand out in class). Please describe briefly the similarities and differences. Please discuss the hypotheses associated with each approach.

PROBLEM 12

Please solve problem 6.32 from the book.

PROBLEM 13

Using the conditions of Problem 7, please compute Manning's n of such a pipe.

PROBLEM 14

Please solve problem 6.103 from the book.

EXTRA CREDIT PROBLEM

PROBLEM E4

Please explain/detail the steps needed to solve the flow problems in pipes in parallel, i.e., the problem of calculating the head loss and the problem of calculating the discharge. Are there easy cases in these problems?