CEE 3500 – Assignment No. 19

Part 1. From the textbook, solve the following problems using:

(a) The Moody diagram

(b) Haaland's equation for calculating the friction factor f in an iterative procedure

(c) Swamee-Jain's equation for calculating the friction factor f in an iterative procedure

The problems to solve are:

8.30 (type 1 problem - head loss problem)

8.41 (type 2 problem – discharge problem)

8.42 (type 3 problem – sizing problem)

Summarize your results in a table like this:

	Moody diagram	Haaland's equation	Swamee-Jain's equation
Problem 8.30	*F =* *Moody diagram*	*F =* *Hf =*	*F =* *Hf =*
Problem 8.41	*F =* *Q =*	*F =* *Q =*	*F =* *Q =*
Problem 8.42	*F =* *D =*	*F =* *D =*	*F =* *D =*

For details on solving *Part 1* of this assignment, using calculators, see pages 4-5 and 6-8 in the document entitled *Pipe with friction losses – solutions using HP and TI calculators*. If you don't have a calculator where you can define functions for the friction factor you use the Excel worksheet provided in the class web site.

Part 2. From the textbook, solve the following problems using a numerical solver in your calculator. If you don't have a calculator with a numerical solver use the Excel worksheet provided in the class web site.. The equations to solve are:

(a) $$Q = -2.22\sqrt{\frac{gD^5 h_f}{L}} \cdot \log\left(0.27 \cdot \frac{e}{D} + 1.775 \cdot \frac{\nu}{D} \cdot \sqrt{\frac{L}{gDh_f}}\right)$$ DWCWQ(13)

(b) $$Q = -2.0\sqrt{\frac{gD^5 h_f}{L}} \cdot \log\left(0.234 \cdot \left(\frac{e}{D}\right)^{1.11} + 5.42 \cdot \frac{\nu D}{Q}\right)$$ DWHAQ(14)

(c) $$Q = -2.22\sqrt{\frac{gD^5 h_f}{L}} \cdot \log\left(0.27 \cdot \frac{e}{D} + 4.62 \cdot \left(\frac{\nu D}{Q}\right)^{0.9}\right)$$ DWSJQ(15)

The problems to solve are:

8.31 (type 1 problem – find the head loss only – kW loss = power = $\gamma Q h_f$)

8.40 (type 2 problem – discharge problem)

8.43 (type 3 problem – sizing problem)

Summarize your results in the following table:

	Equation (13)	Equation (14)	Equation (15)
Problem 8.31	*Hf =*	*Hf =*	*Hf =*
Problem 8.40	*Q =*	*Q =*	*Q =*
Problem 8.43	*D =*	*D =*	*D =*

For details on solving *Part 2* of this assignment with calculators see pages 8-11 in the document entitled *Pipe with friction losses – solutions using HP and TI calculators*. You can also use the Excel worksheet for solving these problems.

Part 3. Solve problem **8.38** using functions *fHA* and *fSJ* as described in page 3 and in examples 9-12 of pages 14-15 of the document entitled *Pipe with friction losses – solutions using HP and TI calculators*. If you don't have a calculator where you can define those functions for the friction factor you can use the Excel spreadsheet provided in the class web site.

Part 4. Solve problem **8.38** using (a) the Hazen-Williams equation with $C_{HW} = 130$ and (b) the Manning's equation using $n_m = 0.010$ rather than using the absolute roughness and kinematic viscosity data in the original problem statement.

See pages 15-18 of the document entitled *Pipe with friction losses – solutions using HP and TI calculators* to give you an idea on how to solve these type of problems.

What to submit? For *Part 1* submit the table showing iterations, if any, as well as the summary table. For *Part 2* submit the summary table only. For *Parts 3, 4,* and *5* show the problem set up up to the derivation of the equations that were entered in the numerical solver in calculators or with the Excel worksheet, then show the solution thus obtained.