ME 3700 - Computer Project #1
Calculating Head Loss and Friction Factor – "The Moody Diagram"
Due by Wednesday at 5pm (October 29, 2003)

(1) Write a computer program (using some flavor of C, Matlab, Basic or FORTRAN, NOT EXCEL) to determine the head-loss (h_L) for a pipe of length *L*, diameter *D*, and mean velocity *V*.

Allow for the following pipe roughnesses:

(i) cast iron
(ii) commercial steel
(iii) drawn tubing
(iv) smooth pipes

The program must either interactively ask the user for *L, D, V* and the material of choice, or their should be an "input file" with the choices. The program must output: friction factor, head-loss and Reynolds number (it should indicate whether the flow is in the laminar or turbulent regime). You will need to use an iterative technique based on the empirical parameterization (equation 8.37) in the text. Iterate until the error ε on the friction factor, *f* is suitably small. Why did you choose this value of ε?

Note: you can either have the user input the densities and viscosities of the fluid or you can calculate this information based on the fluid type (e.g., water or air), it's temperature and pressure.

(2) Calculate the h_L for water flowing at 10 ft/sec in a 110-foot long section of 6" diameter commercial steel pipe. What is the friction factor? What is the Reynolds number? Is the flow turbulent? Calculate by hand using the "Moody Diagram" and using your program. Compare the results.

(3) Produce a family of curves (on a log-log plot) that resembles the "Moody diagram" for the following cases:

(i) Laminar flow
(ii) Smooth pipes
(iii) Cast iron
(iv) Commercial steel
(v) Drawn tubing

The range of Reynolds number should be ~10^1 to 10^8. Identify the various flow regimes on the plot.