ME322: Homework #2 ~~Due January 27~~

1. A large artery in a person's body can be approximated by a tube of diameter 9 mm and length 0.35 m. Also assume that blood has a viscosity of approximately $4x10^{-3}$ Ns/m^2, a specific gravity of 1.0, and that the pressure at the beginning of the artery is equivalent to 120 mm Hg. If the flow were steady (it is not) with V=0.2 m/s, determine the pressure at the end of the artery if it is oriented a.) vertically up (flow up) or b.) horizontal.

2. A viscous fluid flow in a 0.1-m-diameter pipe such that its velocity measured 0.012 m away from the pipe wall is 0.8 m/s. If the flow is laminar, determine the centerline velocity and the flowrate.

3. For oil (SG=0.86, μ=0.025 Ns/m^2) flow of 0.3 m^3/s through a pipe with diameter of 500 mm, determine the Reynolds number. Is the flow laminar or turbulent?

4. Oil (SG=0.9), with a kinematic viscosity of 0.007 ft^2/s, flows in a 3-in.-diameter pipe at 0.01 ft^3/s. Determine the head loss per unit length of this flow.

5. Water flows through a horizontal 60-mm-diaameter galvanized iron pipe at a rate of 0.02 m^3/s. If the pressure drop is 135 kPa per 10 m of pipe, do you think this pipe is a) a new pipe, b) an old pipe with a somewhat increased roughness due to aging, or c) a very old pipe that is partially clogged by deposits? Justify your answer.

6. A 3-ft.-diameter duct is used to carry ventilating air into a vehicular tunnel at a rate of 9000 ft^3/min. Tests show that the pressure drop is 1.5 in of water per 1500 ft of duct. What is the value of the friction factor for this duct and the appropriate size of the equivalent roughness of the surface of the duct?

7. Given 90deg threaded elbows used in conjunction with copper pipe (drawn tubing) of 0.75-in. diameter, convert the loss for a single elbow to equivalent length of copper pipe for wholly turbulent flow.