## *Assignment 8 Pipe Friction* NAME David Dammon

***Due: 1 week***

**8.1. Compare the head losses in a 5000-ft long pipe line with an inside diameter of 12 inches, a flow of 6.0 cfs and the following conditions:**

Assume water is flowing in pipe @ 50°F

**a) a smooth wall**

**b) a wall with a roughness height of 10 mm.**

10mm = 0.01m

$V = \frac{Q}{A} = \frac{6\ ft^3/s}{\pi(\frac{6}{12})^2} = 7.639\ ft/sec$

$Re = \frac{VD}{\nu} = \frac{(7.639)(12/12)}{1.41 \times 10^{-5}} = 5.41 \times 10^5$ ($\nu$ = kinematic viscosity)

**Use the Moody Diagram to estimate the friction factor.**

**Ans:**

**a) f =** 0.013

**hL=** 58.90 ft $= f(L/D)(\frac{V^2}{2g}) = (0.013)(\frac{5000'}{1'})(\frac{7.639^2}{2(32.2)}) = 58.90\ ft$

**b) f =** 0.038

**hL=** 172.16 ft $= (0.038)(\frac{5000'}{1'})(\frac{7.639^2}{2(32.2)}) = 172.16\ ft$

**Solution**

**8.2. Determine the Manning's *n* that produces the same head losses as in cases a) and b) in Problem 1.**

Assume pipe is 3/4 full
circumference circle = $2\pi r$

**a) n =** 193.84

**b) n =** 331.40

**Solution**

Manning's formula $Q = c' A R^{2/3} S_f^{1/2} n$ or $h_f = L\left(\frac{nV}{c' R^{2/3}}\right)^2$

$c' = \sqrt{\frac{g}{f}} = \sqrt{\frac{32.2}{1}} = 5.675$

$P_w = \frac{3}{4}(\pi \sim 1\text{ft}) = 2.356\text{ft}$

$R_h = \frac{A}{P_w} = \frac{\pi \cdot .5^2}{2.356} = 0.3334$

$n = \frac{(h_L L)^{1/2} c' R_h^{2/3}}{V}$

a) $\frac{(58.9 \times 5000)^{1/2}(5.675)(0.3334)^{2/3}}{7.639} = 193.84$

b) $\frac{(172.16 \times 5000)^{1/2}(5.675)(0.3334)^{2/3}}{7.639} = 331.40$