CENG101A: Introductory Fluid Mechanics Fall Quarter 2006
http://maecourses.ucsd.edu/mae210a

Homework VIII.

Due *Friday November 17, 2006*, in fourth hour.

Read: Chapter 12

Problems:

1. The pressure rise Δp across a pump can be expressed as $\Delta p = f(D, \rho, \omega, Q)$, where D is the impeller diameter, ρ the fluid density, ω the rotational speed and Q the flowrate. Determine a suitable set of dimensionless parameters.

2. The viscosity μ of a liquid can be measured by determining the time t it takes for a sphere of diameter d to settle slowly through a distance l in a vertical cylinder of diameter D containing the liquid. Assume that $t = f(l, d, D, \mu, \Delta\gamma)$, where $\Delta\gamma$ is the difference in specific weights between the sphere and the liquid. Use dimensional analysis to show how t is related to μ, and describe how such an apparatus might be used to measure viscosity.

3. The design of a river model is to be based on Froude number similarity, and river depth of 3 m is to correspond to a model depth of 100 mm. Under these conditions what is the prototype velocity corresponding to a model velocity of 2 m/s?

4. Consider the flow of water at 20 m/s along a flat plate? At what distance from the leading edge will transition occur?

5. Estimate the drag on a 20-ft tall tower with radius 3 ft at a wind speed of 20 mph.

Comments:

We will not spend much time on Chapter 11, even though the development of dimensionless groups is important in guiding experiments, data analysis, and theory. The material is straightforward and you should read the whole chapter.