

**CE 3305 Engineering Fluid Mechanics**  
**Exercise Set 12 (Dimensional Analysis & Similitude)**  
**Summer 2018 – GERMANY**

**Purpose :** Similitude Relationships

**Assessment Criteria :** Completion, plausible solutions, use **R** as a calculator.

**Exercises**

1. (Problem 8.44 pg 320) A smooth pipe designed to carry crude oil ( $D = 47$  inches,  $\rho = 1.75$  *slugs/ft<sup>3</sup>*, and  $\mu = 4 \times 10^{-4}$  *lb $\cdot$ s/ft<sup>2</sup>*) is to be modeled with a smooth pipe 4 inches in diameter carrying water ( $T = 60^\circ F$ ).

If the mean velocity in the prototype is to be 2 *ft/s*, what should be the mean velocity of the water in the model to ensure dynamically similar conditions?

2. (Problem 8.66 pg 322) Flow around a bridge pier is studied using a model at  $\frac{1}{12}$  scale. When the velocity in the model is 0.9 *m/s*, the standing wave at the pier nose is observed to be 2.5 *cm* in height. What are the corresponding values of velocity and wave height in the prototype?

(Problem 8.66 pg 322) (Continued)