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CH2003 FLUID MECHANICS
Test 1

Max marks 20 **Time 1 hr**
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Answer all questions

1. a) State and explain the significance of Reynolds number. How the flow regimes are divided on the basis of Reynolds number? (1+1)
   b) With the help of a diagram explain the Reynolds experiment. (2)

2. a) Explain the term viscosity and give its units. (1)
   b) On a common axis, make a rough plot of stress vs. deformation curve for water and air. (1)
   c) How does viscosity vary with temperature for gases and liquids? (1)
   d) What are Newtonian and Non-Newtonian fluids? (Explain using a plot of stress vs. deformation) (1)
   e) Give the power law equation for modeling Non-Newtonian fluids. (1)

3. Give the expression for capillary rise height h of a liquid inside a capillary of diameter d. (1)

4. If an object has a mass of 2.0 slugs at sea level, what would be its mass at a location where the acceleration due to gravity is 30.00 ft/s^2? (1)

5. The velocity distribution of a viscous liquid (dynamic viscosity = 0.9 Ns/m^2) flowing over a fixed plate is given by u = 0.68y - y^2 (u is velocity in m/s and y is the distance from the plate in m). What are the shear stresses at the plate surface and at y=0.34 m? (1.5)

6. If the resistance to motion, R, of a sphere through a fluid is a function of the density ρ and viscosity μ of the fluid, and the radius r and velocity u of the sphere, show that R is given by

$$R = \frac{\mu^2}{\rho} f\left(\frac{\rho u r}{\mu}\right)$$

Hence show that if at very low velocities the resistance R is proportional to the velocity u, then R = kμru, where k is a dimensionless constant.
A fine granular material of specific gravity 2.5 is in uniform suspension in still water of depth 3.3m. Regarding the particles as spheres of diameter 0.002 cm find how long it

will take for the water to clear. Take k=6π and μ=0.0013 kg/ms. [Hint: Solve by Dimensional Analysis] (4.5)

7. Liquid A weighs 53.5 lb/ft^3 and liquid B weighs 78.8 lb/ft^3. Manometer liquid M is mercury.
   a. If the pressure at B is 30 psi, find the pressure at A. (1)
   b. What would be the manometer reading if $P_B - P_A$ = 165 kpa (2)