1. A fluid has a specific gravity of 0.98 and a kinematic viscosity of 6.5 St. What is its absolute viscosity in USC units? (15%)

2. Express a pressure of 8 psi in (a) inches of mercury, (b) pascal. (15%)

3. A pipeline carries oil, sp gr 0.86, at v = 2 m/s through 200-mm-ID pipe. At another section the diameter is 70 mm. Find the velocity at this section and the mass rate of flow in kilograms per second. (15%)

4. The losses $\Delta p/L$ in turbulent flow through a smooth horizontal pipe depend upon velocity v, diameter D, dynamic viscosity μ, and density ρ. Use dimensional analysis to determine the general form of equation

$$F\left(\frac{\Delta p}{L}, v, D, \rho, \mu\right) = 0 \qquad (15\%)$$

5. For a fluid between two plates, the upper plate has a velocity of U and the bottom plate is fixed. Please draw a figure and derive the equations of (a) velocity distribution and (b) flow rate for this fluid. (15%)

6. Please draw a figure, use the momentum equation and derive the equation of thickness of laminar boundary layer, $\delta = f(x, U, \rho, \mu)$, for

$$\frac{u}{U} = F = \frac{3}{2}\eta - \frac{\eta^3}{2} \quad 0 \le y \le \delta \quad \text{and} \quad F = 1 \quad y \ge \delta$$

(15%)

7. In Fig.7, $L_1 = 3000$ ft, $D_1 = 1$ ft, $\epsilon_1 = 0.001$ ft; $L_2 = 2000$ ft, $D_2 = 8$ in, $\epsilon_2 = 0.0001$ ft; $L_3 = 4000$ ft, $D_3 = 16$ in, $\epsilon_3 = 0.0008$ ft; $\rho = 2.00$ slugs/ft^3, $\nu = 0.00003$ ft^2/s, $p_A = 80$ psi, $z_A = 100$ ft, $z_B = 80$ ft. For a total flow of 12 cfs, determine flow through each pipe and the pressure at B. (10%)

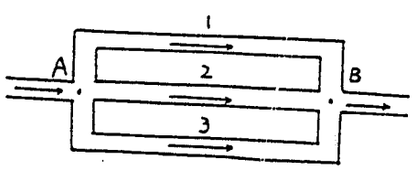

Fig. 7

總分為 100分