四能二流體力學第一次期中考考古題

1. Let two layers of fluid be dragged alone by the motion of an upper plate as shown in Fig. 1. The bottom is stationary. The top fluid puts a shear stress on the upper plate, and the lower fluid puts a shear stress on the bottom plate. Determine the ratio of these two shear stresses. (20%)

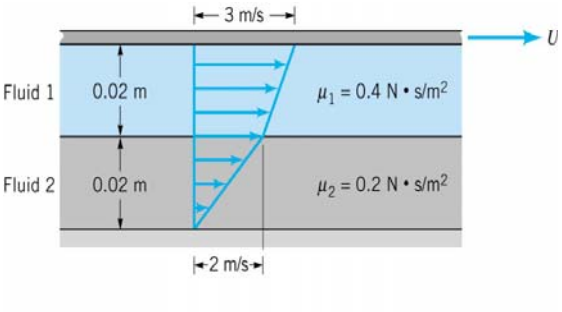

Fig. 1

2. The venturi meter shown in Fig. 2 carries water at 60 ^{0}C (The specific weight γ= 9.65 kN/m^3). The specific gravity of the gage fluid in the manometer is 1.25. Calculate the velocity of flow at section A and the volume flow rate of water. (20%)

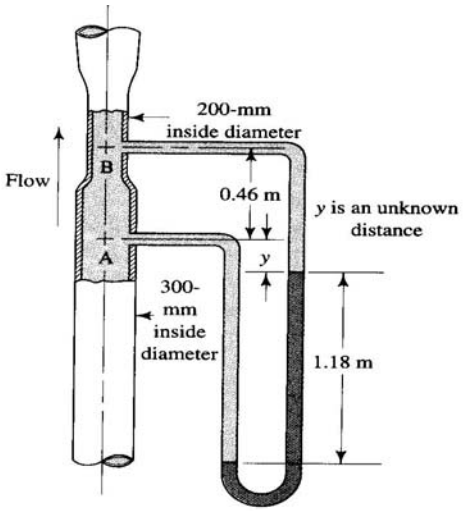

Fig. 2

3. A stream of water of diameter d= 0.1 m flows steadily from a tank of diameter D= 1.0 m, as shown in Fig. 3. Determine the volume flow rate, Q (m^3/s), needed from the inflow pipe if the water depth remains constant, h= 2.0 m. (20%)

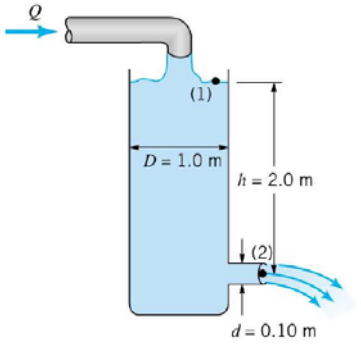

Fig. 3

4. A rectangular container of water undergoes constant acceleration down an incline as shown in Fig. 4. Determine the slope of the free surface using the coordinate shown. (20%)

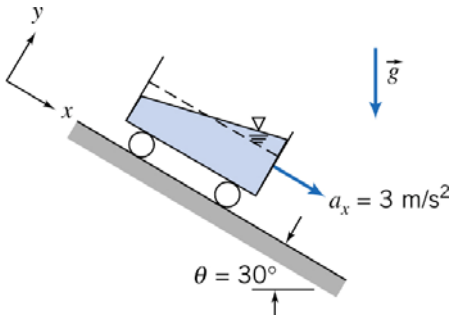

Fig. 4

5. A conical pointed shaft turns in conical bearing. The gap between shaft and bearing is filled with heavy oil having the viscosity of SAE oil at 30 °C (μ= 0.2 N·s/m^2). (1) Obtain an algebraic expression for the shear stress that acts on the surface of the conical shaft. (2) Calculate the viscous torque that acts on the shaft. Assume that the velocity profile of oil is linear. (20%)

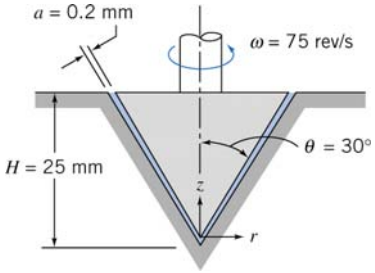

Fig. 5