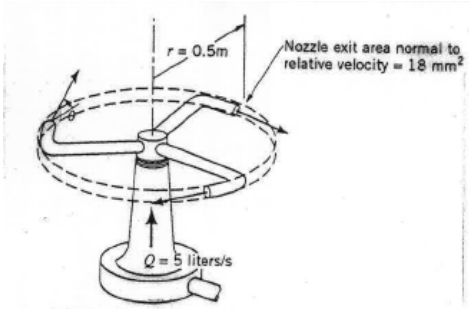
Homework 6 – Due March 22
Problems 5.52, 5.54, 5.56, 5.70, 5.90, 5.92

1) 5.52 - Five liters per second of water enter the rotor shown in the figure along the axis of rotation. The cross sectional area of each of the three nozzle exits normal to the relative velocity is 18 mm^2. How large is the resisting torque required to hold the rotor stationary if (a) $\theta=0^o$, (b) $\theta=30^o$ and (c) $\theta=60^o$



■ FIGURE P5.52

2) 5.54 - Five liters per second of water enter the rotor shown in the figure along the axis of rotation. The cross sectional area of each of the three nozzle exits normal to the relative velocity is 18 mm^2. How fast will the rotor spin steadily if the resisting torque is reduced to zero if (a) $\theta=0^o$, (b) $\theta=30^o$ and (c) $\theta=60^o$

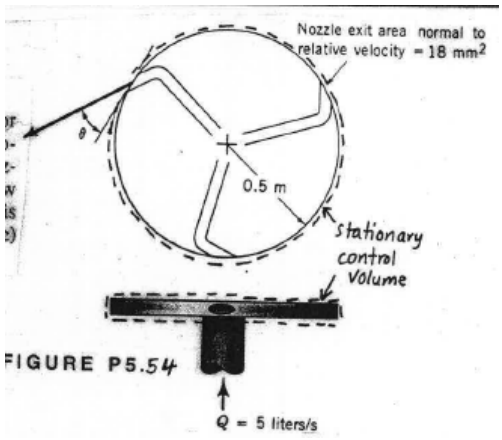
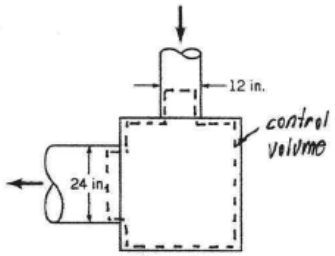


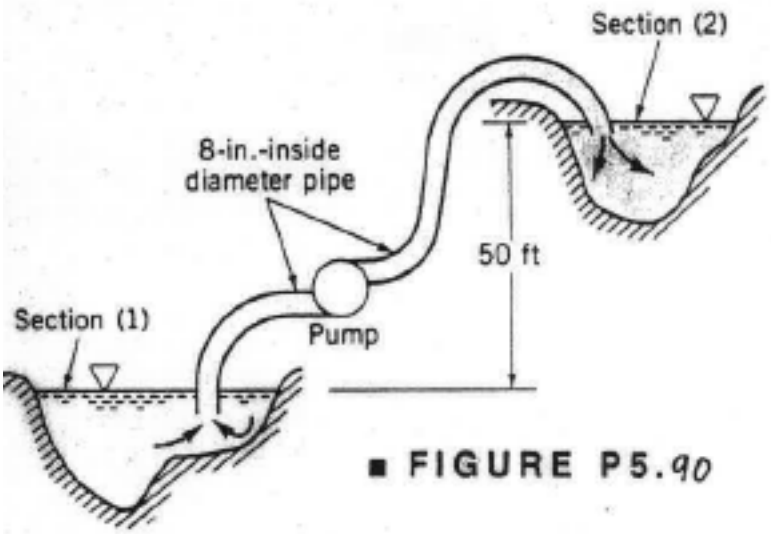
FIGURE P5.54

3) 5.70 – Water flows through a valve as shown in the figure with a weight flow rate of mg of 1000 lb/s. The pressure just upstream of the valve is 90 psi and the pressure drop across the valve is 5 psi. The inside diameters of the valve inlet and exit pipes are 12 and 24 inches. If the flow through the valve occurs in a horizontal plane, determine the loss in available energy across the valve.



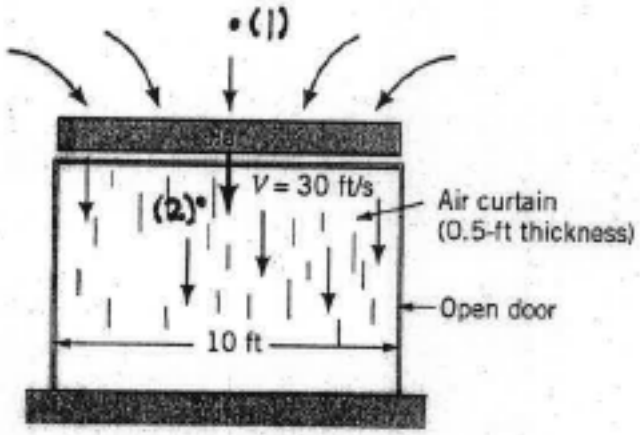
■ FIGURE P5.70

4) 5.90 – Water is to be moved from one large reservoir to another at a higher elevation as indicated in the figure. The loss in available energy associated with 2.5 ft^3/s being pumped from section (1) to (2) is (61/2) V^2 ft^2/s^2, where V is the average velocity of the water I the 8 inch inside diameter piping. Determine the amount of shaft power required.



■ FIGURE P5.90

5) 5.92 – The fan shown in the figure produces an air curtain to aeparate a loading dock from a cold storage room. The air curtain is a jet of air 10 ft wide, 0.5 ft thick moving with a speed of V=30 ft/s. The loss associated with this flow is loss=K $V^2/2$ wher K=5. How much power must the fan supplu to the air to produce the flow.



■ FIGURE P5.92