The University of Melbourne
ENGR30002 Fluid Mechanics

Workshop 03 – *Bernoulli Equations*

Part A

Question 01

The velocity of a moving fluid can be found from the difference between the total and static pressures P_t and P_s. For water, this is given by V = $1.016P_t$-P_s. Write a function, **CalVelocity**, that will receive the input arguments of total and static pressure and will return the velocity of the water.

Question 02

For a project, some biomedical engineering students are designing a device that will monitor a person's heart rate while on a treadmill. The device will let the subject know when the target heart rate has been reached. A simple calculation of the target heart rate (**THR**) for a moderately active person is:

$$THR = (220 - A) \times 0.6$$

where A is the person's age. Write a fuction, **CalTHR**, that will calculate and return the **THR**, given the age.

Part B

Question 01

Consider a liquid of density ρ flowing from Section 1 to 2. Due to the reducing cross-sectional area, the liquid goes through a sudden contraction before exiting to the atmosphere.
Write a function to take four inputs (P_1, V_1, D_1, and D_2) and return two outputs (-V_2 and F), F: the force exerted by the fluid on the contraction. Use $P_a = 100$ kPa.

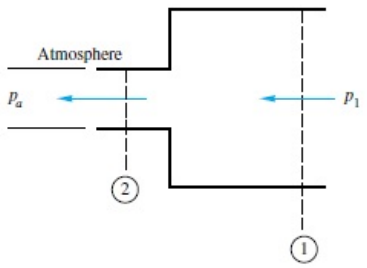

Figure 1: Liquid exiting through the converging part of the pipe

Question 02

A stream of kerosene (SG = 0.85) of a diameter d flows steadily from a storage tank of diameter D. Fresh kerosene is continuously provided with the flowrate Q.

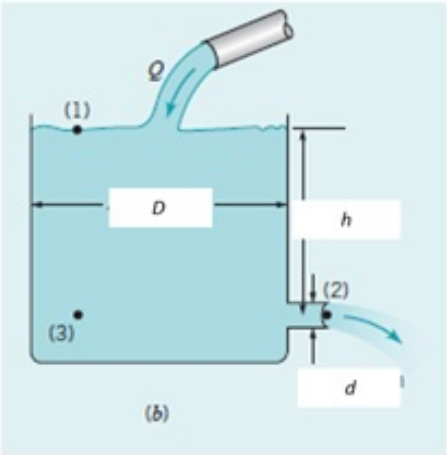

Figure 2: Water exiting

(1) Write a function, **StoTank**, to take three inputs (D, h, d) and return two outputs (V_2, Q) if the depth of kerosene in the storage tank is to remain constant at h.

(2) Plot a graph of V_2 vs d/D for $h = 0.5$ m and $0 \leq d/D \leq 0.7$ comment on your result.

(3) If d/D =0.3 and $0 \leq h \leq 1.5$, how does V_2 change? Plot a graph of V_2 vs h and comment on your result.

(4) If (3) is chosen in Figure 2 instead of (2), do you still obtain the same result?

(5) In your calculation, does the assumption of V_1 =0 or $V_1 \neq 0$ produce different results? Plot a graph of Q ($V_1 \neq 0$) / Q_0 (V_1 =0) vs d/D if $0 \leq d/D \leq 0.8$, and comment on your result.

END OF WORKSHOP