The University of Melbourne
ENGR30002 Fluid Mechanics

Workshop 06 – *Pump*

Part A:

The *Fibonacci sequence* is named after Leonardo of Pisa, who introduced the sequence in his book Liber Abaci published in 1202. The Fibonacci numbers are computed according to the following relation:

$$F_n = F_{n-1} + F_{n-2}$$

with $F_0 = F_1 = 1$ by definition. In other words, after F_0 and F_1, each number in the series is the sum of the previous two. Write a function **fib(n)** that returns a vector containing the first **n+1** Fibonacci numbers (i.e. up to F_n).

Part B

Question 01

The water requirements for a small farm are to be met by pumping water from a well that can supply water continuously at a rate of 4 L/s. The water level in the well is 20 m below the ground level, and water is to be pumped to a large tank on a hill, which is 58 m above the ground level of the well, using 5-cm internal diameter plastic pipes as shown in Figure 1.

- The total minor loss coefficient due to the use of elbows, vanes, etc. is estimated to be 12.
- Take the efficiency of the pump to be 75 percent.
- Water temperature in the well: 20 °C
- Absolute roughness of plastic pipes: 0.0015 mm

(1) How does the pipe length affect pump power? Plot a graph of pump power (kW) versus pipe length (m)

(2) Determine the rated power of the pump that needs to be purchased in kW if the length of pipe is 400 m.

Question 02

A 3-m-diameter tank is initially filled with water at 30°C 2 m above the center of a sharp-edged 10-cm-diameter orifice in Figure 2. The tank water surface is open to the atmosphere, and the orifice drains to the atmosphere through a 100-m-long pipe.

(1) To drain the tank faster, a pump is installed near the tank exit. Write a code to determine how much pump power input is necessary to establish an average water velocity of 4m/s when the tank is full at Z =2m.

(2) If the discharge velocity remains constant, what is the estimated time required to drain the tank? Change the code from (1) accordingly and then plot a graph of Z (m) versus time (s).

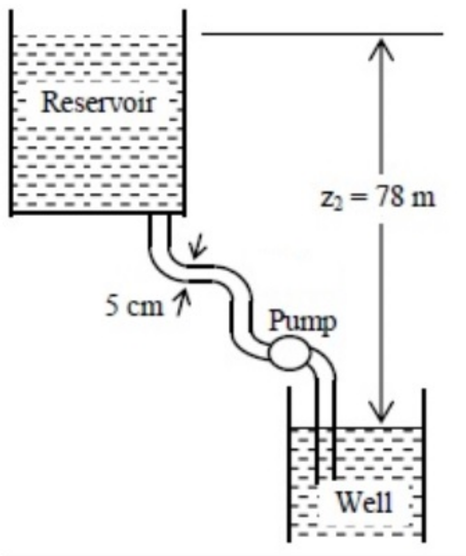

Figure 1: Pumping water from the well to the reservoir

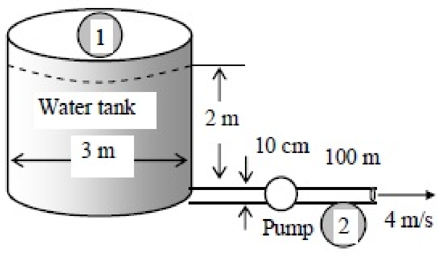

Figure 2: Draining the water tank through the orifice