UCE-305 FLUID MECHANICS
Tutorial No. 6 (Fluid Dynamics - Bernoulli's Equation)

Q1: The discharge through a 250 mm diameter horizontal pipe increases linearly from 30 to 150 litres per sec of water in 3.5 seconds. What pressure gradient must exist to produce this acceleration? Also, determine the difference in pressure between the two sections 8 m apart.

Q2: A pipe line carrying oil of specific gravity 0.80 changes in diameter from 300 mm at section **1** to 600 mm diameter at section **2** which is 5 m at a higher level. The pressures at sections **1** and **2** are 100 kN/m^2 and 60 kN/m^2, respectively. Determine the direction of flow the loss of head if discharge is 300 litres per sec.

Q3: A 6 m long pipe is inclined at an angle of 20^o with the horizontal. The smaller section of the pipe which is at lower level is of 100 mm diameter and the larger section of the pipe is of 300 mm diameter. If pipe is uniformly tapering and velocity of water at the smaller section is 1.8 m/s, determine the difference of pressures between the two sections.

Q4: A bell mouth entry in front of an air compressor is to be calibrated for discharge though it in terms of height **h** of water in a piezometer as shown in **Figure 1**. Determine the discharge of air though the compressor when **h** =0.20 m. Take density of air as 1.2 kg/m^3.

Q5: For airflow of 2.1 cumec through a venturimeter, what is the area of throat, which will cause water to rise by 20 mm in the piezometer shown in **Figure 2**? The area at the inlet is 0.093 m_2. The specific weight of air may be taken as 11.96 N/m^3. Neglect losses.

Q6: Water is pumped from reservoir **1** to reservoir **2** though a 0.30 m diameter pipe as shown in **Figure 3**. The pressure in the pipeline at point **D** is 564 kN/m^2. The various head losses are: **A** to **B** = 0.70 m, **B** to **D** = 38 $V^2/2g$ and **D to E** = 40 $V^2/2g$. Find the discharge and the power supplied by the pump.

Q7: A closed tank containing water is partly filled with water and the air space above it is under pressure. A 50 mm hose connected to the tank discharges water to atmosphere on to the roof of a building 3 m above the level of water in the tank as shown in **Figure 4**. If friction losses are 1.5 m of water, what air pressure must be maintained in the tank to deliver 15 lps to the roof?

Q8: Water enters a turbine vertically through a pipe 0.4 m diameter and leaves through a draft tube as shown in **Figure 5.** If efficiency of turbine is 80% and discharge is 1000 lps, determine (**i**) the power developed by the turbine and (**ii**) the reading of gauge **G**.

Answers:

Q1: - 498 N/m^2/m, - 4482 N/m^2 **Q2:** 1 to 2, 5.96 m **Q3:** 18.4 kN/m^2 **Q4:** 1.8 m^3/s **Q5:** 0.021 m^2 **Q6:** 0.17 m^3/s, 65.9 kW **Q7:** 73.3 kPa **Q8:** 344.6 kW, - 32.7 kPa

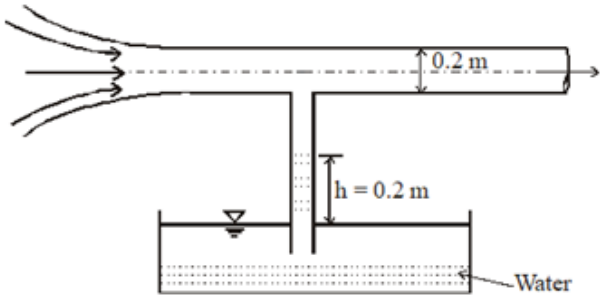

Figure 1

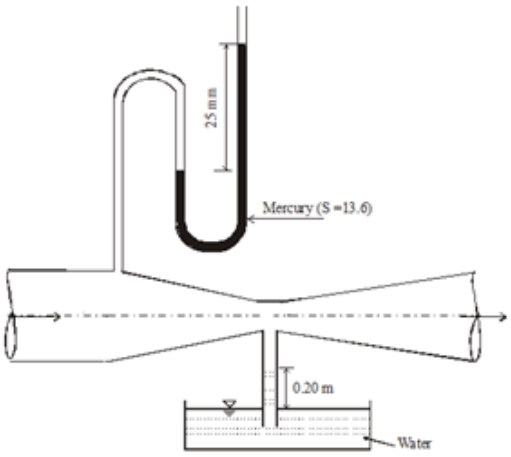

Figure 2

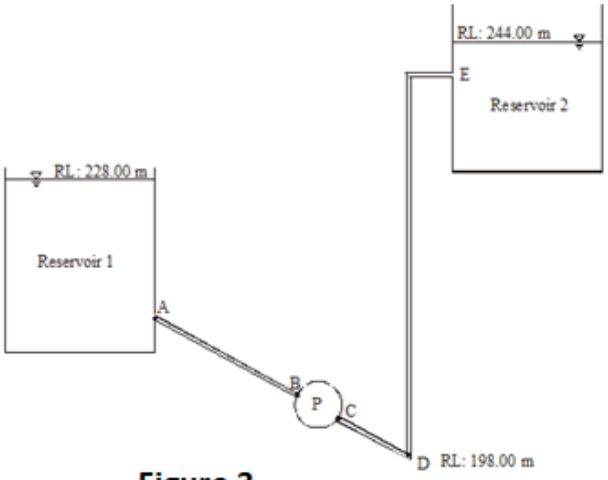

Figure 3

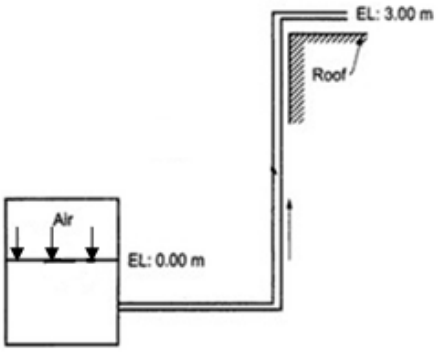

Figure 4

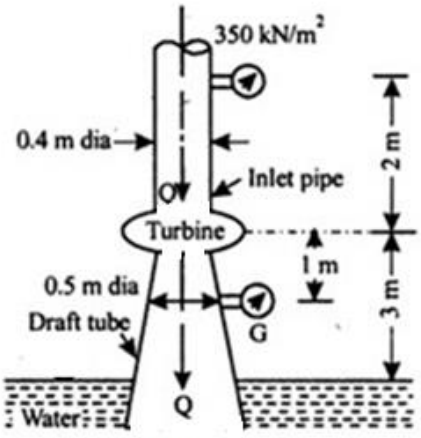

Figure 5