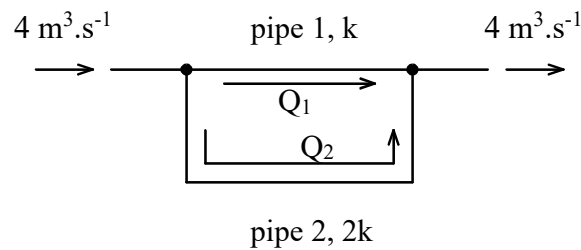# Assignment 01 – Fluid Network Analysis, Fans & Pumps, and Space Air Diffusion

1.   Fluid Network Analysis

1.1   Determine the volume flow rate in each branch of the loop as shown below by using (i) equivalent pipe method, and (ii) Hardy-Cross method.


1.2   Find the flow in the pipeline of the following diagram using Hardy Cross Method. Assume K for vertical members are 3 and horizontals are 5.
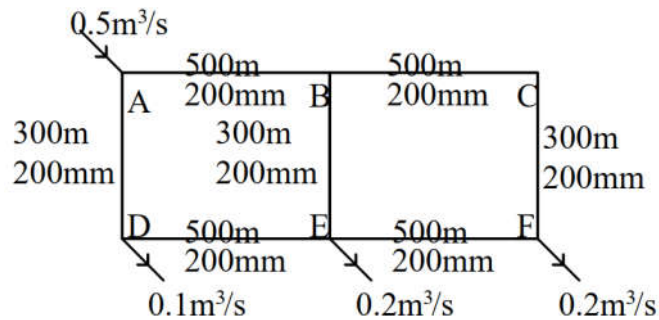
2.   Pumps and Fans

2.1   A centrifugal pump has a 100 mm diameter suction pipe and a 75 mm diameter delivery pipe. When discharging 15 L/s of water, the inlet water mercury manometer with one limb exposed to the atmosphere recorded a vacuum deflection of 198 mm; the mercury level on the suction side was 100 mm below the pipe centerline. The delivery pressure gauge, 200 mm above the pump inlet, recorded a pressure of 0.95 bar. The measured input power was 3.2 kW. Calculate the pump efficiency.
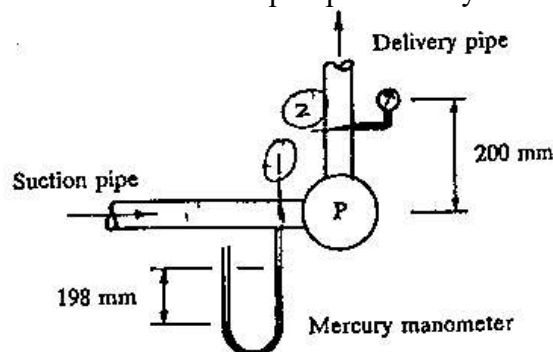
2.2   A centrifugal supply air fan is being run at a speed of 1600 RPM to deliver the required system air flow of 1500 L/s. The fan total pressure rise at this air flow is 350 Pa. The inlet air to the fan does not come into contact with the heat emitted from the drive motor. The overall fan efficiency is 55% and this includes the losses in the impeller and the fan casing. Air enters the fan at 20 °C dry bulb. Estimate the temperature of the supply air as it leaves the fan and comment on the result.

3.   Space Air Diffusion

3.1   A room with dimension 10 m by 8 m and height 3 m is ventilated by a supply air flow rate of 500 L/s. Calculate the air exchange rate and the time constant of the supply air. If the age of air is found out to be 10 minutes, calculate the air change effectiveness of the system. Comment on the performance of the air distribution system.

3.2   Compare the principles and characteristics of mixing flow and displacement flow. Briefly explain the advantages and disadvantages of displacement ventilation systems. Illustrate your answer with examples, diagrams or figures if needed.