

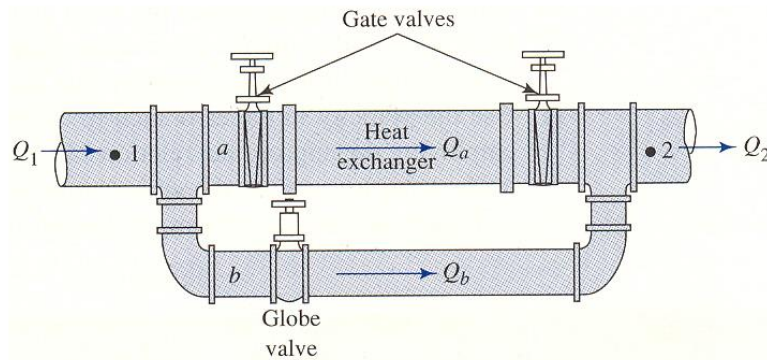
Addis Ababa Institute of Technology

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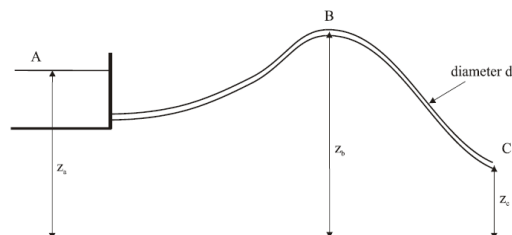
Hydraulics-II (CENG-2162)

Assignment 3(Closed Conduit Flow)

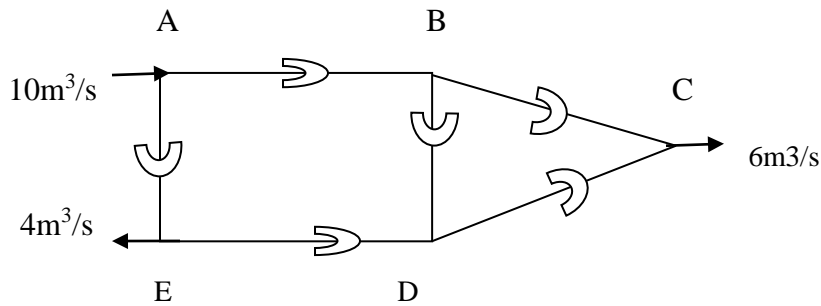
- 1) As in the Fig shown below, 100 gal/min of water at 60F is flowing in a 2-inch sch 40 pipe at section 1. The heat exchanger in branch “a” has a loss coefficient $K = 7.5$ based on the velocity head in the pipe. All three valves are wide open. Branch “b” is a 1 ¼ inch sch 40 pipe. Elbows are standard. The length of pipe between points 1 and 2 for branch b is 20 ft. Because of the size of the heat exchanger the length of the pipe in branch “a” is short and friction loss can be neglected. For this arrangement, determine
- volume flow rate Q in each branch;
 - pressure drop between points 1 and 2.



- 2) The pipe diameter shown in the figure below is 100mm and has a length of 15m and feeds directly into the atmosphere at a point C which is 4m below the surface of the reservoir. The highest point in the reservoir is point B, which is 1.5m above the surface of the reservoir and 5m along the pipe measured from the reservoir. Assume the entrance and exit to the pipe to be sharp and the value of friction factor f to be 0.08. calculate
- Velocity of water leaving the pipe at point C.
 - Pressure in the pipe at pint B.



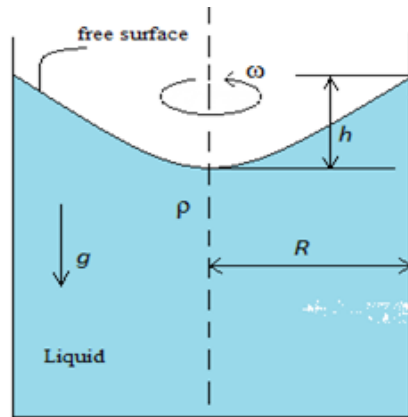
3) Determine the flow rate in each pipe in the network bellow using hardy cross method.



Pipe	Length (l, m)	Diameter (ϕ , mm)	Friction factor (f)
AB	200	150	0.02
BC	150	150	
DC	150	150	
ED	200	150	
AE	250	150	
BD	250	150	

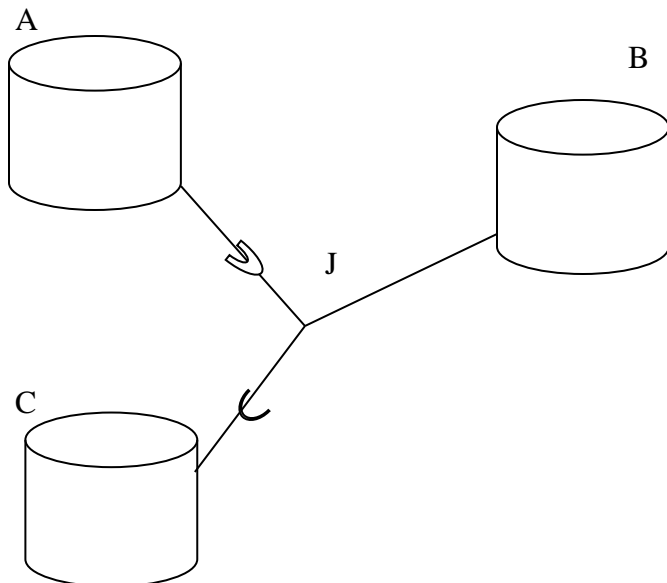
4) A thin rectangular plate having width (w) and height (h) is located so that it is normal to a moving stream of fluid. Assume the drag (F) that the fluid exerts on the plate is a function of w and h , the fluid viscosity and density μ and ρ , respectively and the velocity V of the fluid approaching the plate. Determine a suitable set of *pi terms and non dimensional equations* to study this problem experimentally.

5) Consider a liquid in a cylindrical container in which both the container and the liquid are rotating as a rigid body (solid body rotation), the elevation difference between the center of the liquid surface and the rim of the liquid surface h , is a function of angular velocity ω , fluid density ρ , gravitational acceleration g , and radius R (figure below). Use the method of repeating variables (Buckingham's Pi Theorem) to find a dimensionless relationship between the parameters.

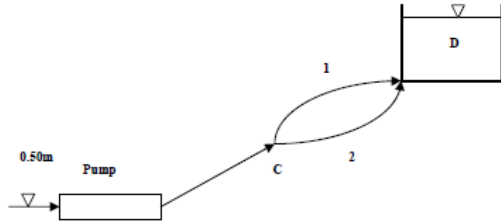


- 6) Reservoirs A, B and C have constant water levels of 150, 120 and 90 m respectively above datum and are connected by pipes to a single junction J at elevation 125 m. The length (L), diameter (D), friction factor (f) and minor-loss coefficient (K) of each pipe are given below. Calculate flow in each pipe?

Pipe	L (m)	D(m)	f	K
JA	1600	0.3	0.015	40
JB	1600	0.2	0.015	25
JC	2400	0.25	0.025	50



- 7) As in the Fig shown below reservoir D is fed by a pump and pipe system. Pressure heads in the pipe flow at the entrance and at the outlet from the pump are respectively 5 and 105 m. The geometric of the pipe before the pump is 0.50 m. The efficient power of the pump is 75 kW. The friction factor at all the pipe system is $f = 0.03$. (Minor losses will be neglected).



- Calculate the discharge in pipe BC,
- What will be the discharges in the parallel C1D and C2D pipes?
- Calculate the water surface level of the reservoir D.
- Draw the energy line of the system.

Pipe	Length (m)	Diameter (mm)	f
BC	1000	300	0.03
C1D	3000	400	0.03
C2D	1500	200	0.03

- 8) As in the Fig shown below, reservoir B is fed by reservoir A with 600 lt/sec discharge. The water surface levels in the reservoirs are $z_A = 100$ m and $z_B = 90$ m. If the pipe diameter is $D = 0.50$ m, the friction factor is $f = 0.02$, and the efficiency factor of the pump is $\eta = 0.70$, calculate the required pump power. The lengths of the pipes are respectively $L_1 = 500$ m and $L_2 = 1000$ m. Draw the energy line of the system

