$Q_1 = 0.0872\ m^3/s$, $Q_2 = 0.0828\ m^3/s$ and $Q_3 = 0.079 m^3/s$

Tutorial

1. A 400 mm straight pipe is used to carry water one reservoir to another reservoir that is 1.7 km away. There is an elevation difference at 9 m between the two reservoirs. Determine the discharge for the following pipe (a) commercial steel, (b) cast-iron and (c) smooth concrete. Take $\upsilon_{water} = (1.141 \times 10^{-6})\ m^2/s$.

2. The 50 m long, 100 mm diameter at commercial steel pipe is used to connect reservoirs A and B as show in Fig T2.2. Determine the flow rate water and static pressure at point a, b, c and d if,

   (a) Reservoir A is subjected to atmospheric pressure and globe valve is fully opened.

   (b) Reservoir A is pressurised to 40 kN/m^2.

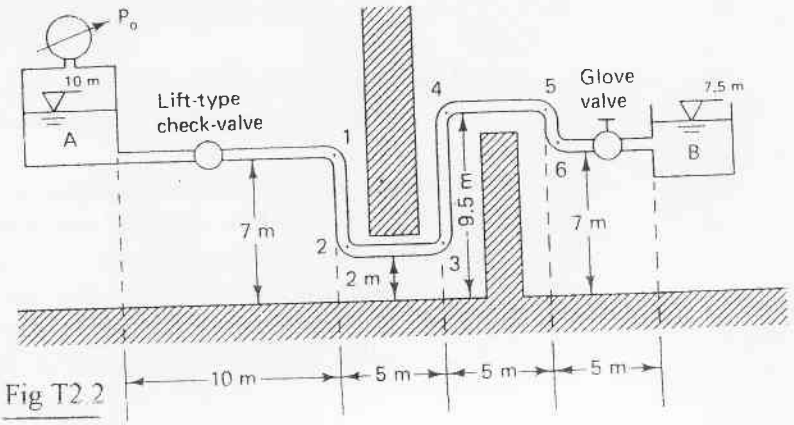

Fig T2.2

3. A pipe 900 m long and 200 mm diameter discharges water to atmosphere at a point 10 m below the level of the inlet. With a gange pressure at inlet of 40 kN/m^2, the steady discharge from the end pipe is 49 lit/s. At a point half along the pipe, a tapping is then made from which water is to drawn off at a rate of 18 lit/s. If conditions are such that the pipe is always full, to what value must the inlet pressure be raised so as to provide an unaltered discharge from the end of the pipe.

4. Two water reservoirs, the surface level of which differs by 1.5 m, are connected by a pipe system consisting at a sloping pipe at each end: 7.5 m long and 75 mm diameter joined by a horizontal pipe 300 mm diameter 60 m long. Taking $f = 0.002(1 + 25/d)$ where d mm is the pipe diameter, calculate the steady rate at flow through the pipe.

5. A single uniform pipe joins two reservoirs. Calculate the percentages increase of flow rate obtainable if, from the mid-point of this pipe, another of the same diameter is added in parallel to it. Neglect all losses except pipe friction and assume a costant and equal friction factor f for both pipes.

6. A pump delivers water through two pipes laid in parallel. One pipe is 100 mm diameter and 45 m long and discharge to atmosphere at a level 6 m above the pump outlet. The other pipe, 150 mm diameter and 60 m long, discharges to atmosphere at a level 8 m above the pump outlet. The two pipes are connected to a junction immediately adjacent to the pump and both have f = 0.032. The inlet to the pump is 600 mm below the level of the outlet. Taking the datum level as that of the pump inlet determine the total head at the pump outlet if the flow rate through it is 0.037 m^3/s. Neglect all minor losses.

7. A straight 250 mm diameter and 5 km long pipeline is laid between two reservoirs having a difference at level of 40 m. Find the increase in discharge, due to installation of the new pipe systems,

   (a) An addtional 2.5 km pipe is laid parallel from the first reservoir to the mid-point of the original pipe.

   (b) An addtional 2.5 km pipe is laid parallel from the lower reservoir to the mid-point of the original pipe.

8. A 600 mm diameter pipe is supplied with water from a reservoir A and at a point D it is divided into branches of 450 mm and 300 mm diameter which discharge into reservoirs B and C respectively. Length of 600 mm, 450 mm and 300 mm pipes are 600 m, 1000m and 500 m respectively. The surface level in reservoir A, B and C are 33.5 m, 21.30 m and 15.25 m respectively. Find the velocity at flow in each pipe, taking f = 0.028.

9. Water flows in parallel pipe system show in Fig T2.9. The supply pipe to point A is of 300 mm diameter and the mean velocity of water in it is 3m/s. If the elevation of point A is 100 m and the elevation of point B is 30 m above the datum, calculate the pressure at point B if that A is 200 kN/m^2. What is the discharge in each pipe? Neglect all minor losses.

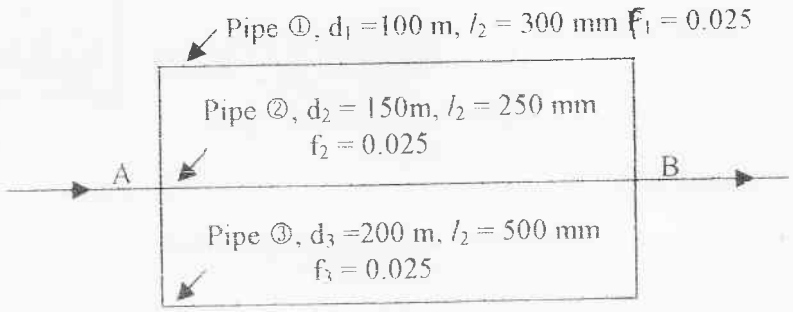

Fig T2 9

10. Water is handled by a system of pipes as shown in Fig T2.10, the details being as flows.

Pipe	Length (m)	Diameter (mm)	Friction factor, f
$A_1B - A_2B$	100	500	0.022
BC	300	750	0.020
CD	500	300	0.025
CE	400	250	0.025
CF	500	300	0.025

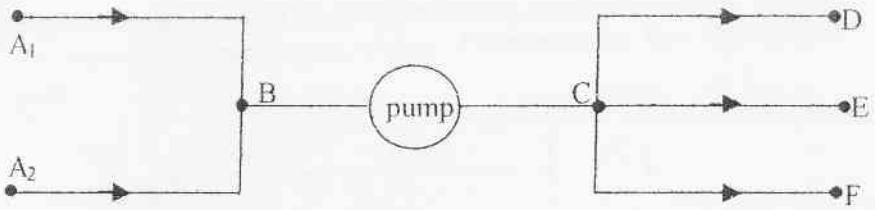

Fig T2.10

The elevation of outlet D, E and F is 100 m above the elevation of inlet A_1 and A_2. All the outlets and are inlets opened to atmosphere. If the mean velocity in pipe A, B and A_2B is 2.5 m/s, calculate the flow rate through the pump, the pressure difference across the pump and the power consumed. Take the pump efficiency as 80%.

11. Parallel cast-iron pipe 1, 2 and 3 in Fig T2.11 carry a total discharge of 0.8 m^3/s. Determine the flow rate in each pipe. Neglect all the minor losses.

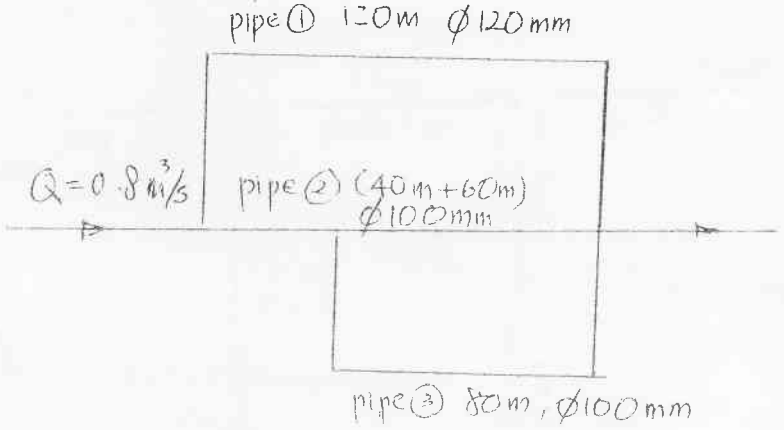

Fig T2.11

12. Find the flow rate of water of water in each pipe at Fig T2.12. All pipe are 65 mm diameter.

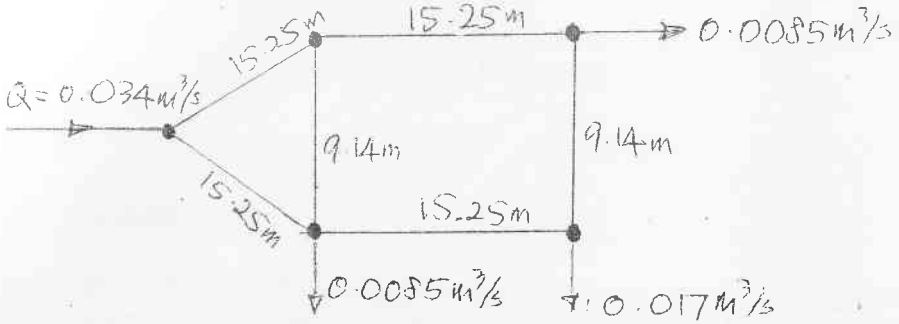

Fig T2.12

13. Fig T2.13 represents a spray rinse system in which water is flowing. All pipe are 75 mm copper tubing. Determine the flow rate in each pipe.

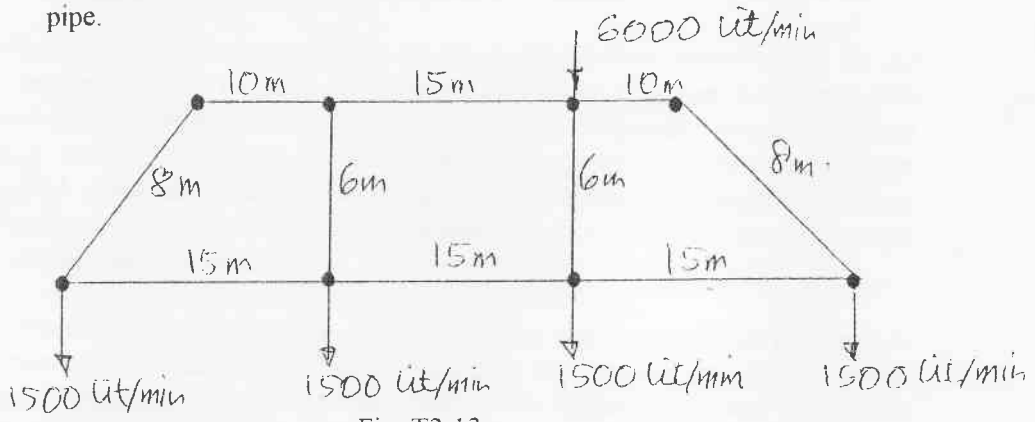

Fig. T2.13

14. Determine the flow rate at water in each cast-iron pipe in the pipe network system shown in Fig T2.14.

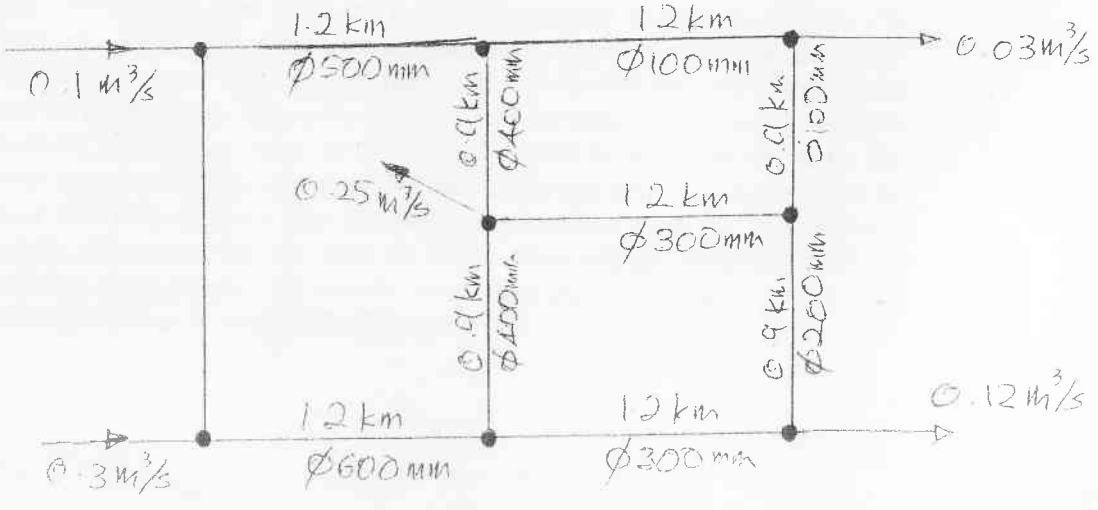

Fig T2.14