**AJAY KUMAR GARG ENGINEERING COLLEGE, GHAZIABAD**
**DEPARTMENT OF CIVIL ENGINEERING**

**SESSIONAL TEST –II** [ Solution ]

Course: B.Tech
Session: 2017-18
Subject: Environmental Engineering-1
Max Marks: 50

Semester: V
Section: CE-1 & CE-2
Sub. Code: NCE-503
Time: 2 hour
Date- 11-10-2017

SECTION-A

1. Attempt all the parts.

Q a) What are the function of service reservoir?

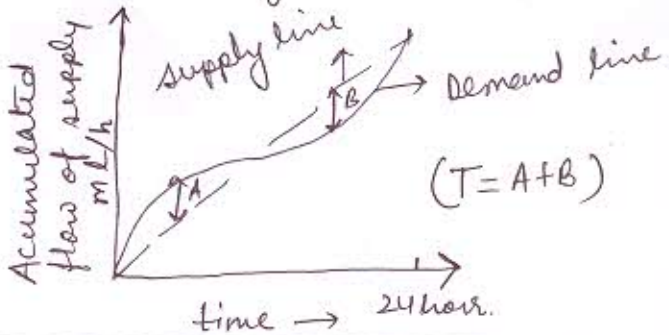
Ans. a) – (i) To store potable water for distribution.
(ii) – To maintain the pressure in distribution mains.
(iii) – To supply for fluctuated demands using mass curve method.

Q. b) Write any four advantages of RCC pipes over CI pipe?

Ans. b) – Advantage of RCC pipes over CI pipe.
(i) – RCC pipes posses less corrosion over CI pipe.
(ii) – RCC pipe are more durable than CI pipe.
(iii) – RCC pipes are used to resists compressive pressure.
(iv) – RCC pipes are less costly than CI pipes.

Q. c) Explain mass curve method used to determine storage capacity of balancing reservoir.

Ans. c) – This curve represent fluctuation of demand over a constant supply. The sum of maximum ordinate of given curve are known as Storage capacity of Balancing Reservoir.



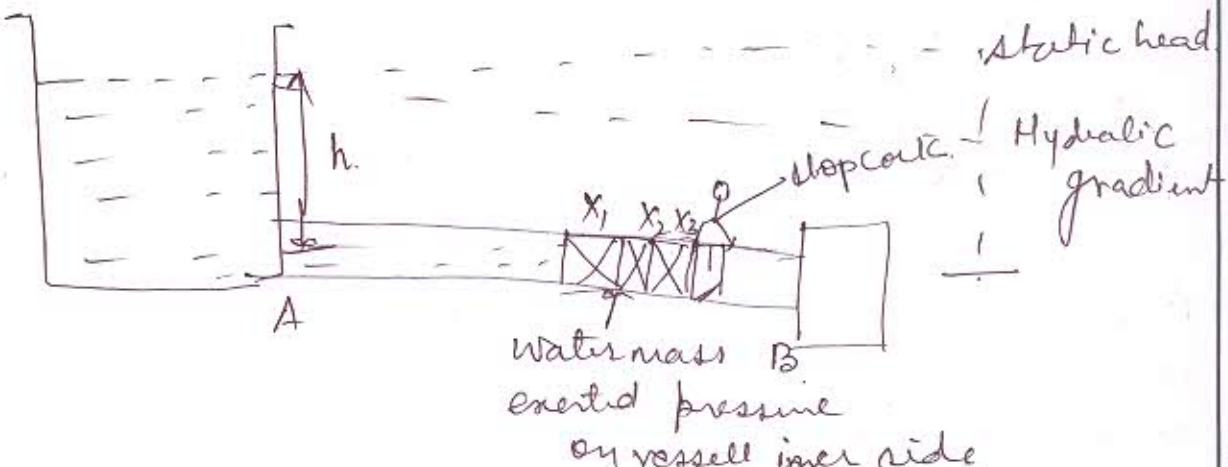
Q. d)- What are the requirements of hot water installation in buildings?

Ans. d)- Requirement of hot water in diff. climate conditions for diff. uses like bathing, washing clothes, Kitchen use etc.

| Different purpose | Temperature required. |
|---|---|
| Sink | 65°C |
| Hot bath. | 45°C |
| Warm bath | 37°C |
| Tipid Bath | 29.5°C |

Ques. e)- What do you understand by water hammer? Explain with neat sketch.

Ans- e) Water hammer is types of inherent pressure exert on pressure pipe when we stop the flow of water suddenly. Due to this pressure hoop stress is created on the pipe circumference & will be equal to $\left(\sigma = \frac{pd}{2t}\right)$.




pressure increases at point-A due to closure of sudden valve on point B.

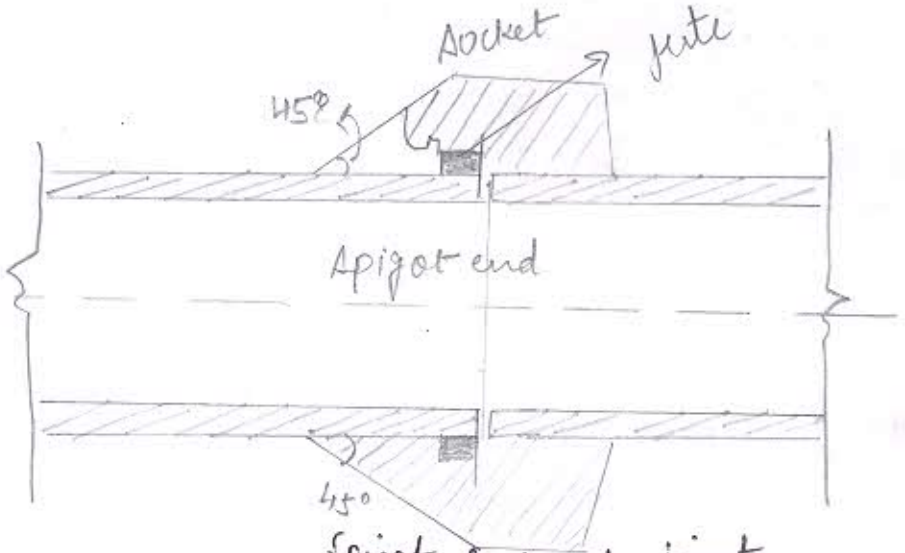
SECTION - B.

Q a) - Draw neat sketch of the following :

Ans (i) Spigot and Socket joint for CI pipe.

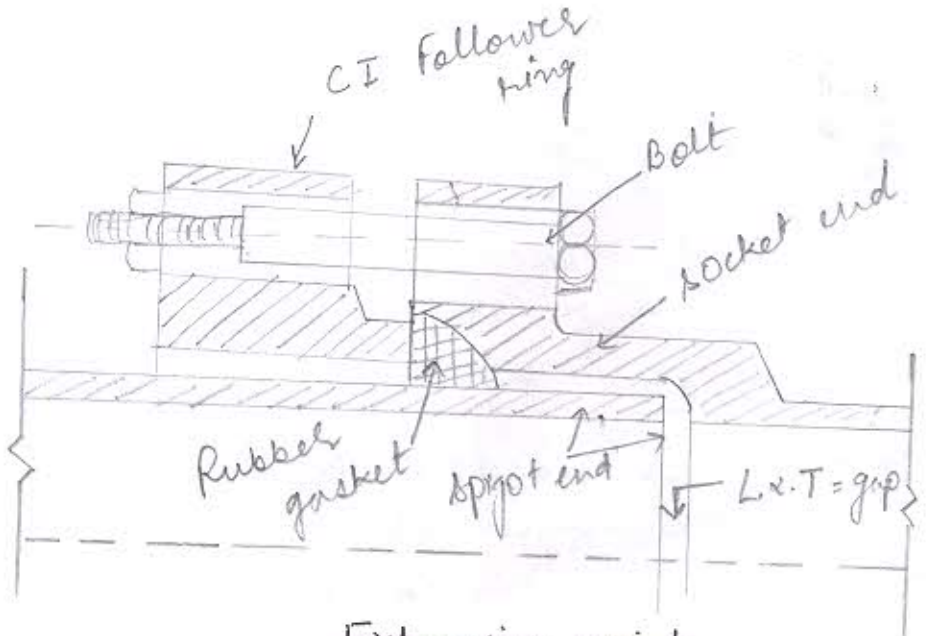
— These types of joints are used for CI pipe.

— Gasket or jute provided for flexibility to CI joint.




Spigot & Socket joint

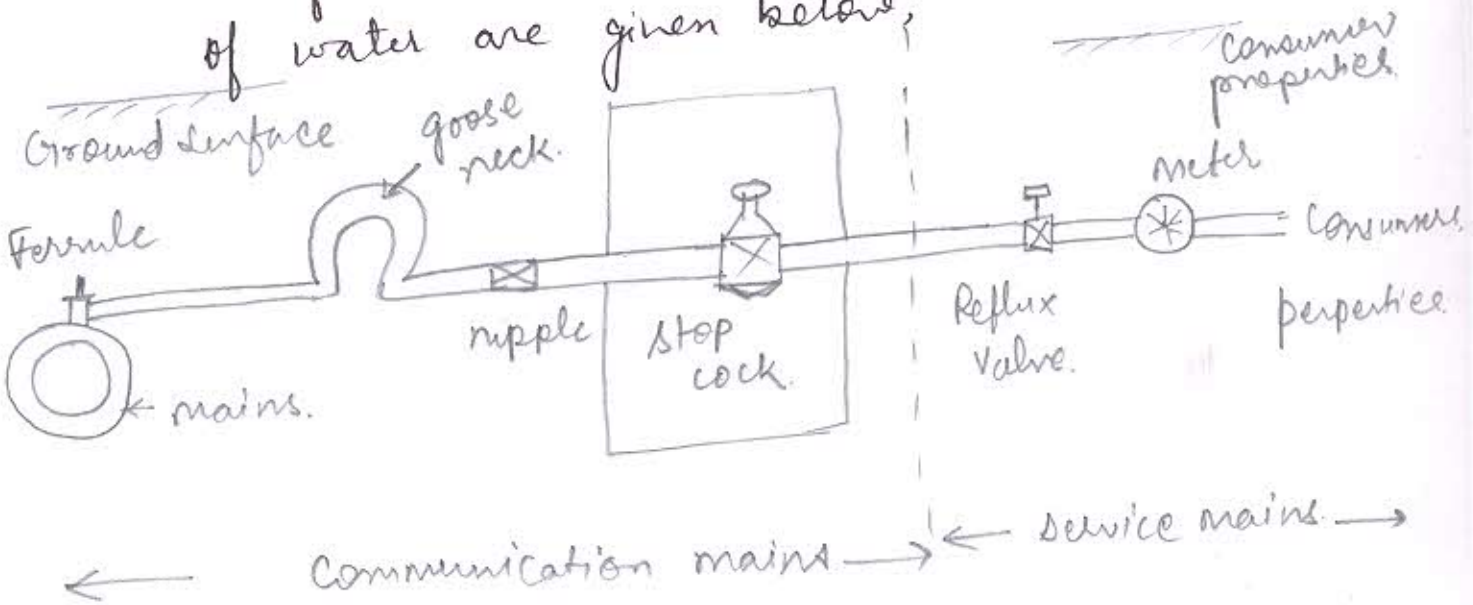
(ii) Expansion joint for CI pipes.




Expansion joint

Ques. 6. Explain with neat sketch as to how municipal water mains are connected to private building and house for giving water supply connections.

Ans - First and main step to get water supply to houses is to obtain a authorised connection from authority of supply mains. Then there are further units that control the supply of water are given below;




Ferrule - made up of brass or gunmetal, dai varies from 5mm to 15 mm. pressure for supply is balanced by it.

Goose neck - it is curved shape pipe made up of flexible material like lead and used to protect pipe by high pressure.

stop cock - it is used to control flow of water to the consumer.

meter - it is provided to obtain the data of consuming water by consumers.

Ques. C- What do you understand by conservancy and water carriage system? Also give comparision.

Ans C- conservancy method- This is Dry method in which waste is collected in Dry condition. No water is used.

Water carriage method- In this method water is used to carry waste material through pipelines.

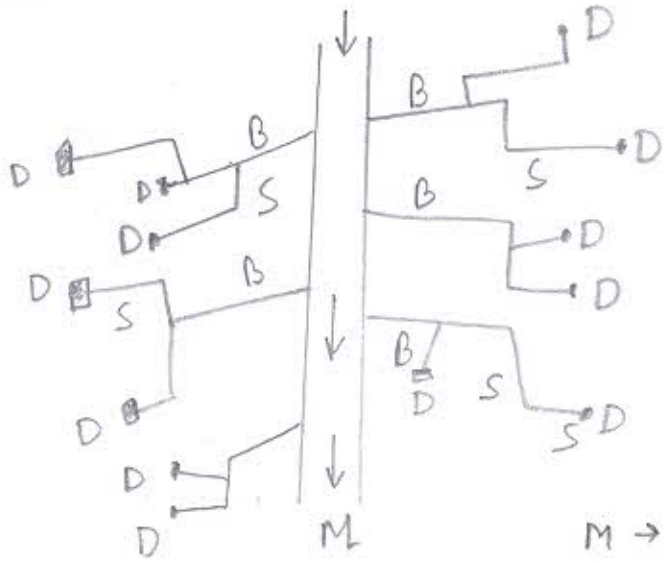
| Conservancy method. | Water carriage method. |
|---|---|
| 1 The sanitation process in which directly Dry wastes are disposed off. is called conservancy method. | 1. The waste is disposd off with water in this method. |
| 2. large area required | 2 less area required. |
| 3: Doesn't provide asthetic appearance to the city | 3. City looks neat and clean. |
| 4. foul smell generated from waste | 4. No foul smells. |
| 5 It depends on labour totlly. In Case of strike, Sanitation may be in danger | 5. It doesn't depend on labour. |
| 6. Unskilled labour is required | 6. Skilled person required to maintain it. |

Qus (d) — Illustrate with neat sketches the different types of layout of pipe system in distributing water. Also compare their merits & demerits.

Ans. d — There are four types of layout of pipes for distribution of water.

① Dead End system ② Grid Iron system
③ Ring system ④ Radial system.

1— Dead End system —




M → Mains.
S → Sub mains.
B → Branches
D → Dead End.

Merits — Expension is easy in future.
— No proper designing is required.
— less No. of pipe are required.

Demerits — Difficult to inspect & maintain.
— At Dead End water pollutes.
— wastage increases at the dead Ends.

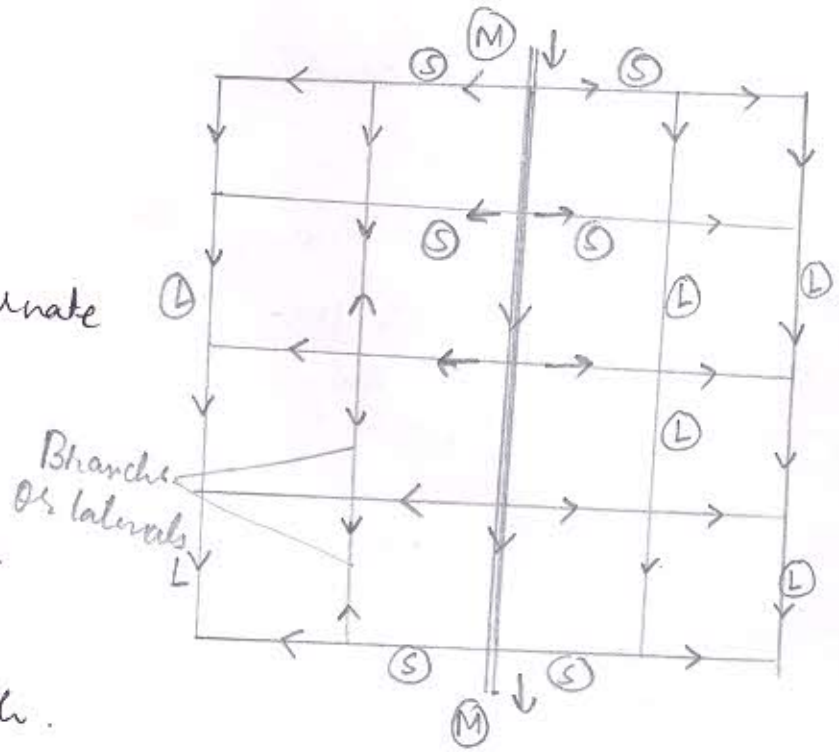
## ② Grid Iron system.

Merits –

- Water distributes in circulation motion.
- During repairs, alternate path is available.

Demerits –

- More no. of value & pipes is required.
- Initial cost is high.
- Maintance cost is also high with comparision to dead end system.




M – Watermains
S – Sub mains
L – Laterals

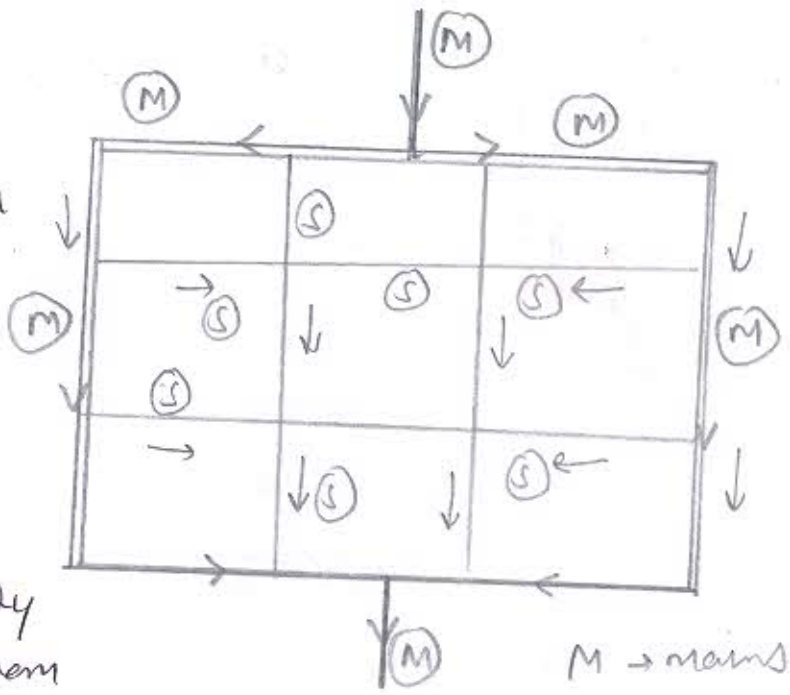
## ③ Ring System –

Merits – more no. of path to distribute water to consumer.

- Easy to maintain.

Demerits –

It required specific location in which city is at lower level than outside location of city.

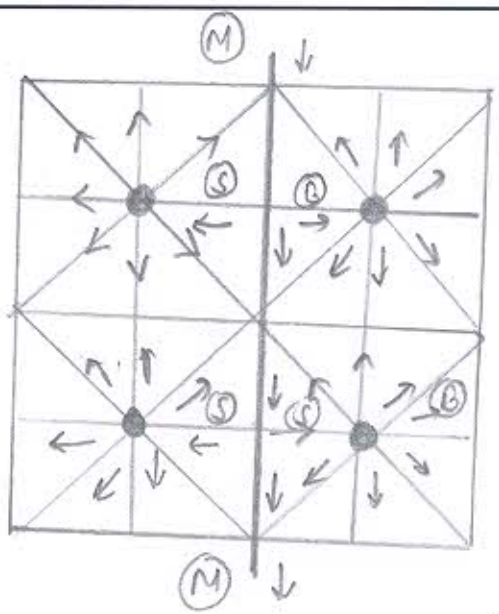



M → mains
S → Sub mains.

(4) Radial System –

Merits – it gives quick service.
– Ensure high pressure
– Efficient water distribution.

Demerits – It is suitable for well designed city only.
– high initial cost.




M → Mains
S – Sub mains
B – Branches
● – Distribution Reservoir

Ques – e – Determine the hydraulic gradient in a 90 cm diameter old cast iron pipe carrying a discharge of 0.75 cumec by using (a) Manning's formula (b) Darcy-Weisbach formula and (c) by Hazen William formula. Assume suitable data.

Ans. diameter = 90cm = 0.9 m, $R = \frac{A}{P_{wetted}} = \frac{d}{4} = 0.225$

$Q = 0.75\ m^3/sec.$

As per given data,

for old pipe, co-efficient of friction

$$f' = 0.04\left[1 + \frac{1}{35d}\right] = 0.042$$

$$f = 4f' = 0.165$$

$$Q = AV \Rightarrow 0.75 = \frac{\pi}{4}(0.9)^2 \times V$$

$$V = 1.18\ m/sec.$$

(a) Darcy - Weisbach formula -

$$H_L = \frac{fLv^2}{2gd} \Rightarrow \frac{H_L}{L} = \frac{0.165 \times (1.18)^2}{2 \times 9.81 \times 0.9}$$

$$\frac{H_L}{L} = \frac{1}{76.858}$$

(b) Mannings formula -

$$H_L = \frac{n^2 v^2 L}{R^{4/3}}$$

$$\frac{H_L}{L} = \frac{n^2 v^2}{R^{4/3}}$$ , n is mannings co-effiant,

assume, $n = 0.013$

$$\frac{H_L}{L} = \frac{(0.013)^2 \ (1.18)^2}{(0.225)^{4/3}} = 1.72 \times 10^{-3}$$

$$\frac{H_L}{L} = \frac{1}{581.3}$$

(c) Hazen - William formula,

$$V = 0.86 \, C_H \, R^{0.63} \, S^{0.54}$$

For Cast Iron $C_H = 130$

$$1.18 = 0.86 \times 130 \times (0.225)^{0.63} \, S^{0.54}$$

$$S^{0.54} = 0.027$$

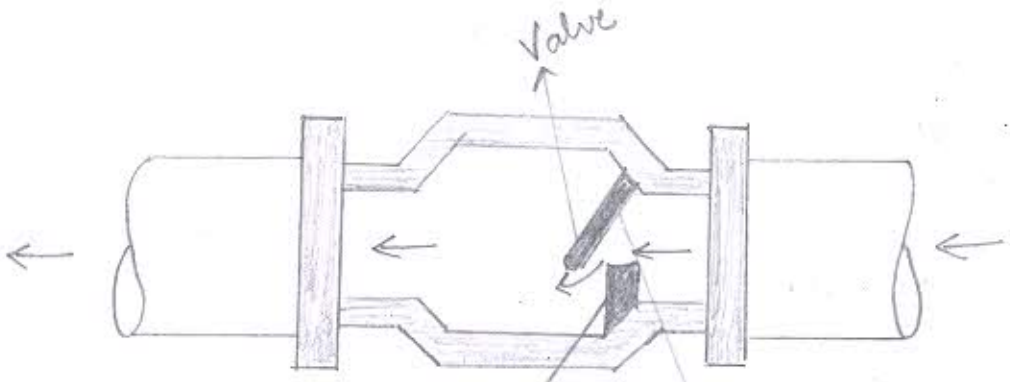
$$S = \frac{1}{806.4}$$ Ans.

SECTION - C

3(a) - Write short note on following;

Ans (1.) - Check Valve or Reflux valve -

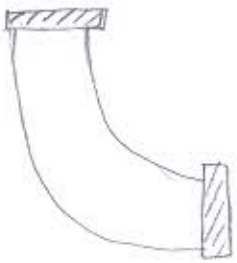
These valve are also known as non return valve because they prevents water to flow back in the opposite direction.



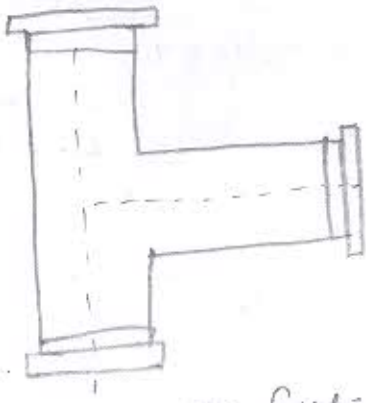

Reflux Valve.

Ans (2) Run off coefficient (C). - It is the percentage of the rainfall that enters into the sewer to the rain water that falls but does not reach the sewer line or drains. Part of it is lost due to percolation, evaporation and storage in ponds and ditches of the area. The runoff coefficient C, is expressed as a dimensionless decimal the represents the ratio of runoff to rainfall.

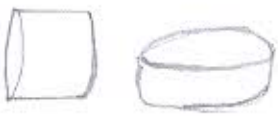
(3) Pipe fittings — In addition to the pipes valves tapes, various type of pipe fitting such as unions, caps, plugs, flanges, crosses, tees, elbows, bends etc., are used during laying of distribution pipes.



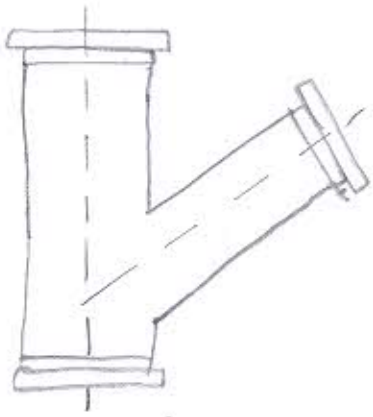
Elbows or bends.



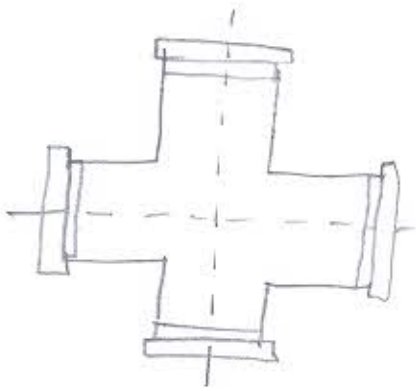
T- fitting



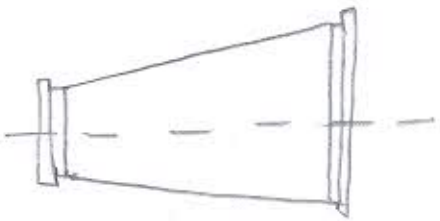
Caps



Wyes.

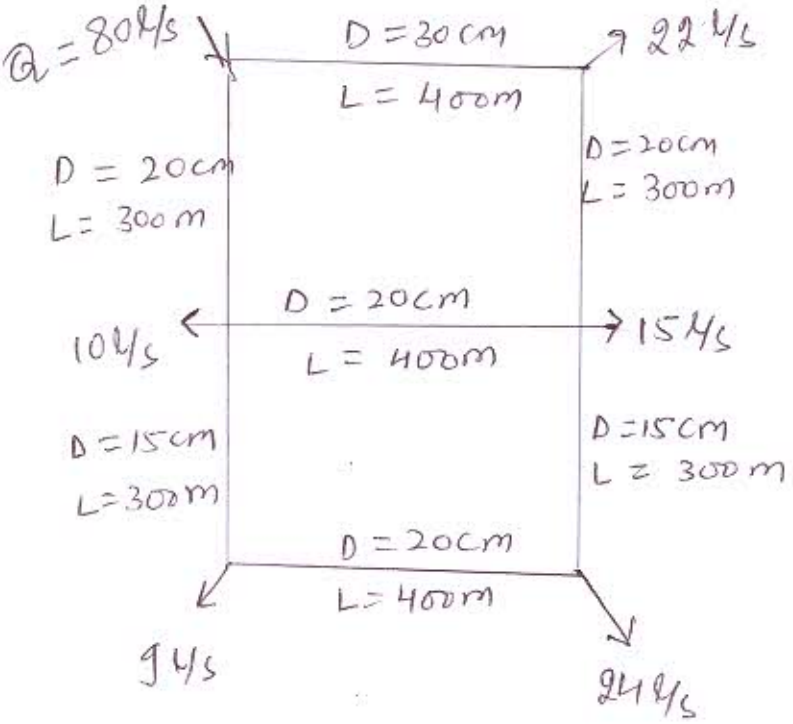


Cross.

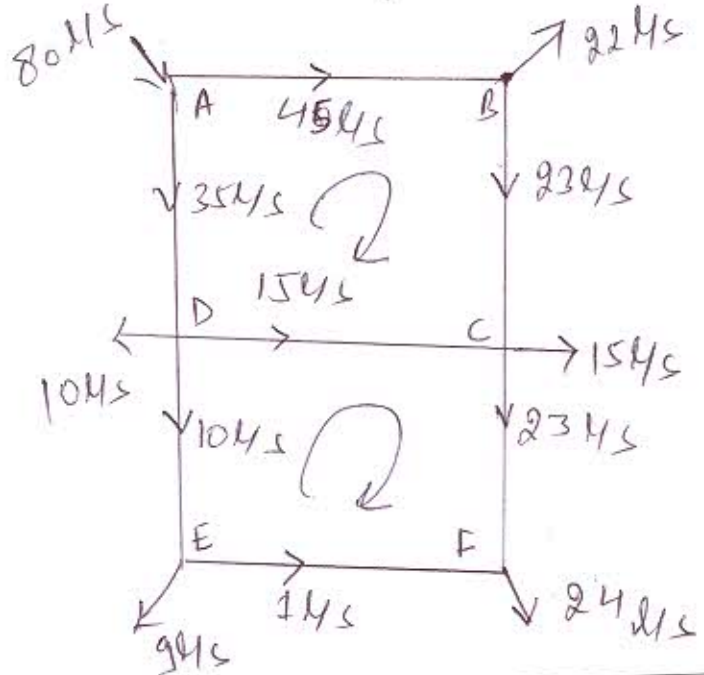


Increaser

Ques-3(b) – Calculate the head losses and the corrected flows in given distribution network. Make use of Hardy-Cross method with William-Hazen's formula.




Ans – Assumed flow –




Hazen-william

$H_L = K Q^{1.85}$

$\left[ K = \frac{L}{470 \cdot d^{4.87}} \right]$

$[x = 1.85]$

For loop ABCDA,

| Pipes | $Q_a$ (l/s) | $Q_a$ ($m^3/s$) | K | $H_L = K Q_a^{1.85}$ | $\left\|\frac{H_L}{Q_a}\right\|$ | Corrected flow (l/s) |
|---|---|---|---|---|---|---|
| AB | 45 | 0.045 | 299.5 | 0.966 | 21.5 | 48.3 l/s |
| BC | 23 | 0.023 | 1618.1 | 1.51 | 65.65 | 26.83 l/s |
| CD* common pipe | −15 | −0.015 | 2157.5 | −0.911 | 60.73 | −11.2 l/s |
| DA | −35 | −0.035 | 1618.1 | −3.277 | 93.63 | −31.2 l/s |

$\Sigma H_L = -1.712$, $\Sigma\left|\frac{H_L}{Q_a}\right| = 241.51$

$$\Delta_1 = \frac{-\Sigma H_L \times 1000}{x \cdot \Sigma\left|\frac{H_L}{Q_a}\right|} = +3.83 \text{ l/s}$$

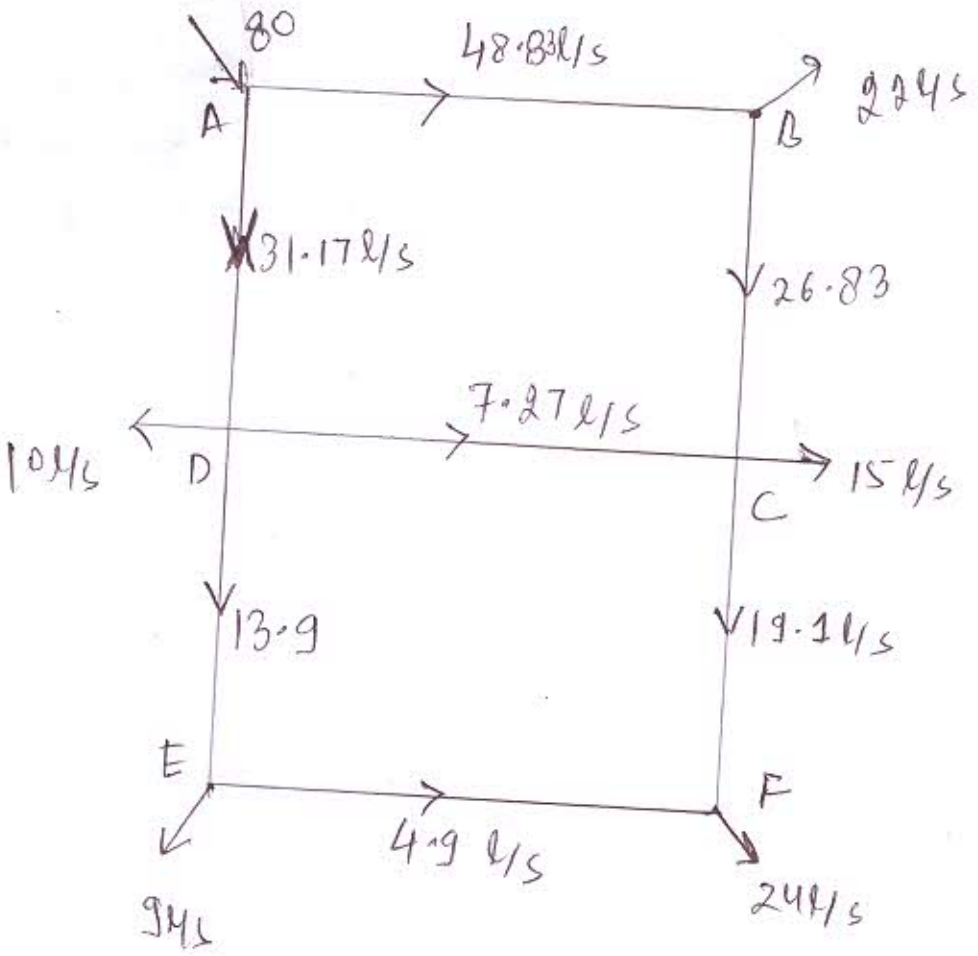
For loop DCFED,

| Pipes | $Q_a$ (l/s) | $Q_a$ $m^3/s$ | K | $H_L = K Q_a^{1.85}$ | $\left\|\frac{H_L}{Q_a}\right\|$ | Corrected flow (l/s) |
|---|---|---|---|---|---|---|
| DC* | 15 | 0.015 | 2157.5 | 0.911 | 60.73 | −11.1 l/s |
| CF | 23 | 0.023 | 6568.4 | 6.12 | 266.1 | 19.1 l/s |
| FE | −1 | −0.001 | 2157.5 | −0.0061 | 6.1 | −4.9 l/s |
| ED | −10 | −0.01 | 6568.4 | −1.311 | 13.11 | −13.9 l/s |

$\Sigma H_L = 5.714$ $\Sigma\left|\frac{H_L}{Q_a}\right| = 346.03$

$$\Delta_2 = \frac{-\Sigma H_L \times 1000}{x \cdot \Sigma\left|\frac{H_L}{Q_a}\right|} = -3.9 \text{ l/s}$$

Corrected flows-




Ans