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INTRODUCTION TO SANITATION

* Garbage :-

This term is used to indicate dry refuse and it includes decay fruits grass leaves, sweepings and vegetables etc.

* Sewage :-

The term is used to indicate the liquid waste from the community and it includes sullage, discharge from urinals, stables etc., industrial waste and storm water (rain)

* combined sewage :-

It indicates the combination of sanitary sewage and the storm water with or without industrial waste

* Sullage :-

waste water from bathrooms, kitchen etc.

* Sewer :-

The underground conduit or drain through which sewage is conveyed

* Sewerage :-

The entire science of collecting and carrying sewage and treatment through sewer

* Rubbish :-

All sundried solid waste are papers, broken furnitures, waste, waste building materials, pottery etc.

* Methods of collection :-

Two types

① conservancy system

② water carrying system

* Sewerage system

Three types

① combined → Storm water + Domestic waste → single pipe

② seperate → 2 pipes < Storm / Domestic

③ ..

Heavy rains during small period

③ partially separate

① Combined system :-

When only one set of sewer is laid carrying both the sanitary sewerage and storm water

combined system is mostly used in the areas having small rainfall which is evenly distributed throughout the area

In crowded areas also this system is used

② seperate system :-

When the domestic and Industrial sewage are taken in one set of sewers where as storm and surface water are taken is another set of sewers

Rainfall is heavy when it is short period, it is better to provide separate system

③ partially separate system:-

If a portion of storm water is allowed to entire in the sewers to carrying sewage and the remaining storm water flows in separate set of sewers

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* **Factors affecting sanitary sewage:-**

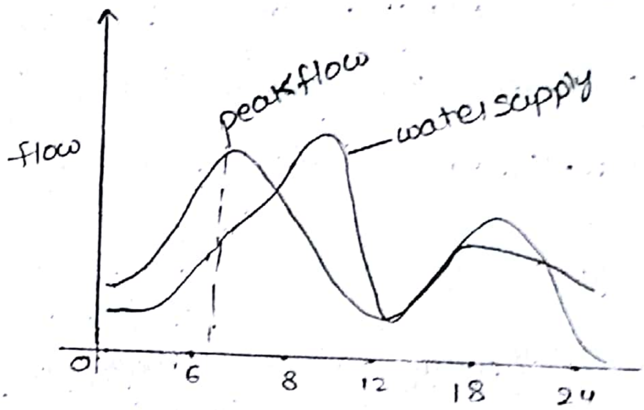
→ Population

→ Rate of water supply — lit/capita/day

→ Type of area served as residential, industrial

→ Ground water infiltration

* **Variation of sewage:-**



→ Dry weather flow → sanitary sewage.

→ Wet weather flow → storm water

→ net quantity of sewage → water supplied + additional private water + infiltration – subtraction due to water losses – not entering the sewage system

→ maximum daily flow → 2 × annual average daily flow

→ Maximum hourly flow → 1.5 × maximum daily flow
→ 3 times

Minimum daily flow = $\frac{2}{3}$ (annual average daily flow)

Minimum hourly flow = $\frac{1}{3}$ (minimum daily flow)

= $\frac{1}{3}$ (annual average daily flow)

Note:-

Generally 70 to 80% of accounted water supply is considered as quantity of sewage produced

* A city has a projected population of 60,000 spread over an area of 50 hectors Find the design discharge for the separate sewer line by assuming rate of water supply of 250 LPCD (Lit/capital day demand) and out of this total supply only 75% reaches in sewer as waste water. Make necessary assumptions.

Sol Given data: Population = 60,000

Rate of supply = 250 litre/capital day demand

↓

75%

Sewarage = 60,000 × 250 × 0.75

= 1125×10^4 litre/day

= $\frac{1125 \times 10^4 \times 10^{-3}}{24 \times 60 \times 60}$ [1 litre $= 10^{-3} m^3$]

Discharge = 0.13 m^3/sec

Assuming peak factor is in b/w 1 to 2.5

Total design discharge = 2 × 0.13

= 0.26 m^3/sec

* Factors affecting storm water:-
  - → Area of catchment
  - → shape & size of catchment
  - → nature of soil
  - → Obstructions [trees, fields, garden]
  - → Intensity & duration of rainfall

* Estimation of rainfall

2 methods

① Rational $Q = \frac{CIA}{360}$ (m^3/sec)

A = Area (hectors)

I = Intensity (mm/hr) of rainfall

C = Coefficient of runoff

$= \frac{C_1A_1 + C_2A_2 + \cdots + C_nA_n}{A_1 + A_2 + \cdots + A_n}$

$i = \frac{25.4a}{t+b}$

a = 30, b = 10 when t = 5 to 20 min

a = 40 b = 20 when t = 20 to 100 min

t = time of entry + time of flow

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* Time of concentration:-

The period after which the entire catchment area will start continuity contributy to the runoff

* Time of entry:-

Time taken by the rainfall to run from the most distant point of the watershed to the inlet of the sewer

* Time of flow:-

It is the time required for the flow of water in the sewer to the point under consideration time of concentration = time of entry + time of flow

* The catchment area of a city is 200 hectors. Assuming that the surface on which the rainfall is classified as follows

Type of surface	% of area	Runoff coefficient
Roof	20	0.9
Pavemend & yards	15	0.8
lawns gardens	30	0.15
Macadimised roads	20	0.40
Vacant plots	15	0.10

a) Calculate the impervious factor if maximum intensity of rainfall is 40mm/hr. calculate the quantity of storm water which will reach sewer lines

Sol

Given data $A = 200$ hectoras

$i = 40 \text{ mm/hr}$

$A_1 = \frac{20 \times 200}{100} = 40$ hectors

$A_2 = \frac{15 \times 200}{100} = 30$ hectors

$A_3 = \frac{30}{100} \times 200 = 60$ hectors

$A_4 = \frac{20}{100} \times 200 = 40$ hectors

$A_5 = \frac{15}{100} \times 200 = 30$ hectors

$$C = \frac{C_1A_1 + C_2A_2 + \cdots + C_5A_5}{A_1 + A_2 + \cdots A_5}$$

Impervious factor $C = \dfrac{0.9\times40+0.8\times30+0.15(60)+0.4(40)+0.1(30)}{40+30+60+40+30}$

$= 0.44$

Rational method $Q = \dfrac{CIA}{360}$

$= \dfrac{0.44\times40\times200}{360}$

$\boxed{Q = 9.77\ m^3/sec}$

b) If the density of population is 300 persons per hector and the rate of water supply is 250 lit/capita/day calculate the quantity of sanitary sewage for separate system and partially separate system

$1 \rightarrow 300$ p/hect

$200 \rightarrow$

$200\times300 = 60{,}000$

$Q = \dfrac{60{,}000\times250}{24\times3600}$ ∴ $P\times A\times250$

$= 173.61$ lit/sec

Design discharge $= 2\times173.61$

$= 347.22$ lit/sec

$= 0.347\ m^3/sec$

Partially separate system :-

$Q = \dfrac{CIA}{360}$ C → roofs, pavement & yards

$C = \dfrac{40\times0.9+0.8\times30}{40+30} = 0.857$

$$Q = \frac{0.857 \times 40 \times 200}{360}$$

$$= 19 \ m^3/sec$$

Q = Storm water + Sump

$= 19 + 0.173$

$= 19.173 \ m^3/sec$

* A certain district of a city has a projected population of 50,000 residing over a area of 40 hectors find the design discharge for the ~~follo~~ sewer line for the following data

Rate of water supply = 200 lit/capita/day

Average impermiability coefficient for the entire area = 0.3

Time of concentration = 50 min

The sewer line is to be designed for the flow equivalent to the wet weather flow + twice the dry weather flow use rational method. Assume that 75% of water supply reaches in sewer as waste water

$I = 0.3$

A = 40 hectors

T = 50 min

Population = 50,000

water supply = 200 lit/capita/day

For $t = 50$ min, $a = 40$; $b = 20$

quantity sewarage dry = 50,000 × 200 × 0.75

= 7500000 lit/day

$= \frac{7500000}{24 \times 60 \times 60}$

= 86.80 lit/sec ⇒ 86.80×10^{-3}

0.0868 m^3/sec

$i = \frac{25.4a}{t+b}$

$= \frac{25.4(40)}{50+20}$

= 14.51 mm/hr.

wet weather flow $Q = \frac{CIA}{360}$

$\frac{0.3 \times 14.51 \times 40}{360}$

= 0.483 m^3/sec

Q = wet weather flow + 2 (dry weather flow)

Flow equivalent = 0.483 + 2 (0.0868)

= 0.6566 m^3/sec

closed

pace expected an porarily ied to tratagi

A) Estimate the peak flow in m^3/sec for the design of sewers for a population of 240 per hector spread over an area 12 km^2. assume water supply of 135 lit/capita/day. with a sewage generation of 75% of the water supply.

peak factor 2.25

1 sq km = 100 hect

Given data population = 240/hectare

A = 12 km^2 ⇒ 12 × 100 = 1200 hectares

water supply = 135 lit/capita/day)

sewage entering in a sewer by water supply 75%.

peak-factor = 2.25

Quantity of sewage entered into sewer by water supply

dry weather flow = $\frac{135 \times 240 \times 1200 \times 0.75}{24 \times 60 \times 60}$

Q_1 = 337.5 litres/sec

= 337.5×10^{-3} m^3/sec

= 0.3375 m^3/sec

Quantity of sewage entering due to storm (wet weather flow)

$Q_2 = \frac{CIA}{360}$

Design discharge = peak-factor $\times Q_1$

Q_2 = 2.25×0.3375

= 0.759 m^3/sec

* Discuss the various methods for estimating sewage flow and storm water flow

so: Estimating storm water flow:-

2 methods

① Rational method :-

$Q = \frac{CIA}{360}$

② Empirical formula method :-

(i) Burkli - Zeiglar formula

$Q = 296\ C R_i A (S/A)^{1/4}$

ii) Scouring velocity :-

It is the maximum flow velocity at which there is no scouring of sewer interior material

* Types of sewers :- classification based on material

① Asbestos cement (AC) pipes sewers

no effect to acids & salts
cannot carry heavy loads
They are layed vertically

② Light - weight pipes sewers

③ Steel - sewer

④ Brick - sewer

⑤ plastic - sewer

⑥ CI sewer (cast Iron)

⑦ cement sewer

classification based on layed (collection)

Lateral sewer
sub main sewer
main / trunk sewer
outfall sewer (treatment Plant)

* Sewer appurtenances :-

→ Man hole
deep
medium
shallow

M.

* Drop man hole
* Lamp holes
→ Street inlets

→ catch basin

→ flushing tank

→ Grease and oil traps

→ Inverted siphon

Sewer appurtenances :-

Those structures which are constructed at suitable intervals along a sewerage system and help in its efficient operation and maintanance

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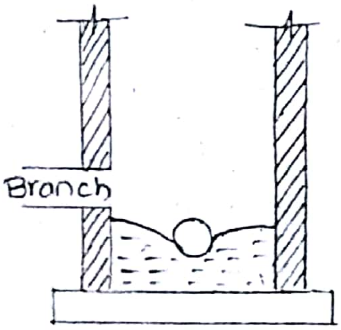
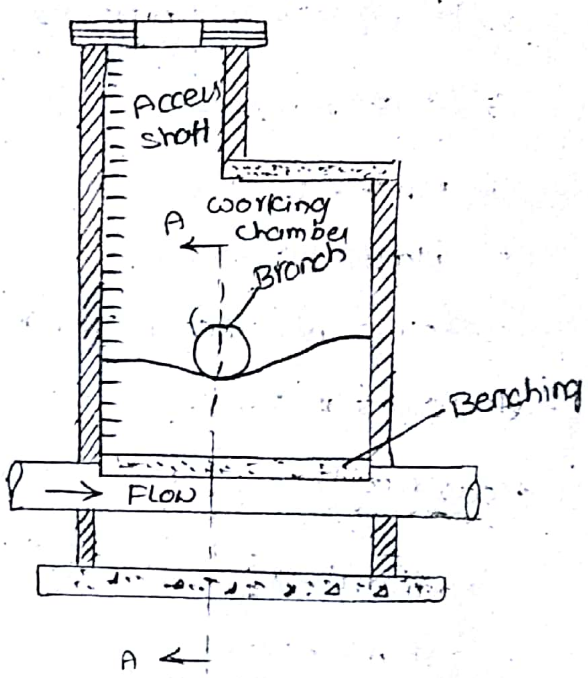
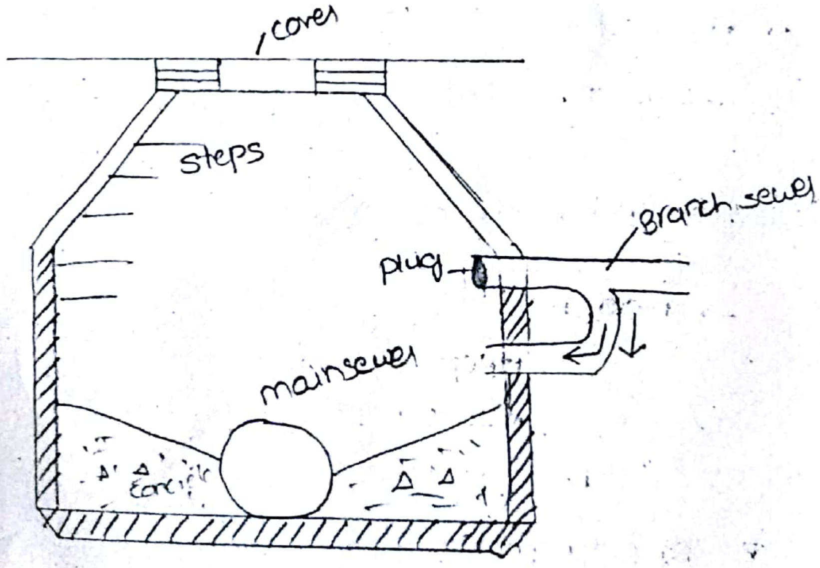
Manholes :

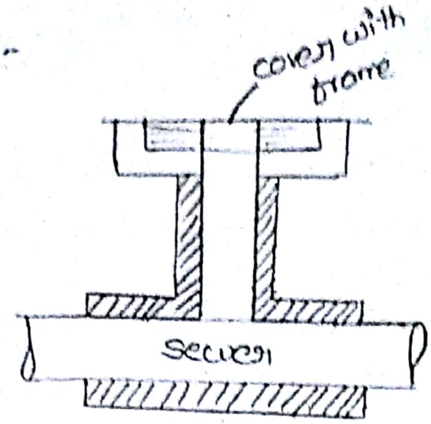




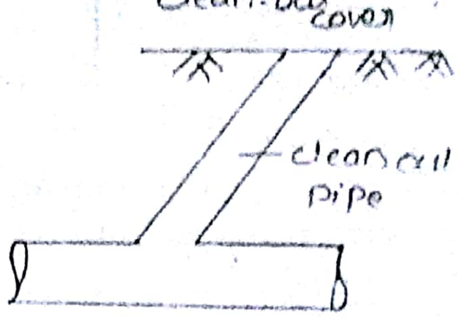
Dropmanhole:-



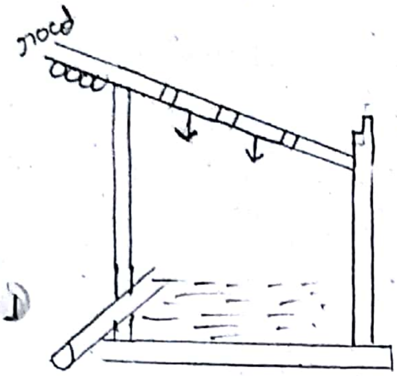
Lamphole :-
(or)
Freshair Inlet



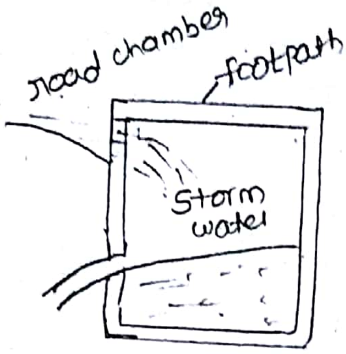
Freshair cleanout



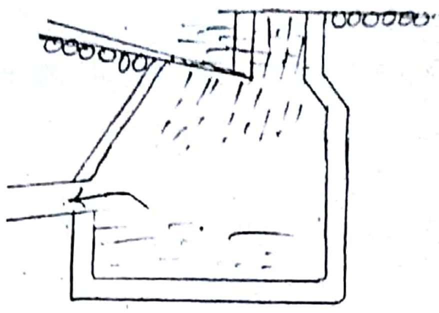
Street inlets : 3 types



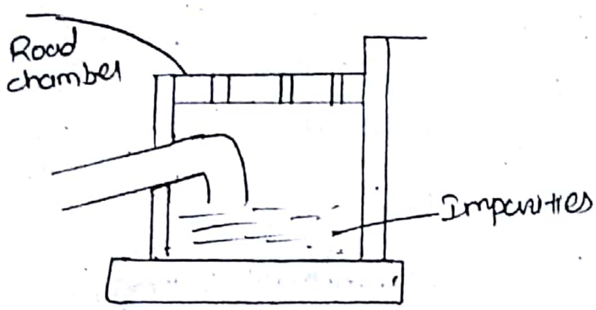
Gutter inlet



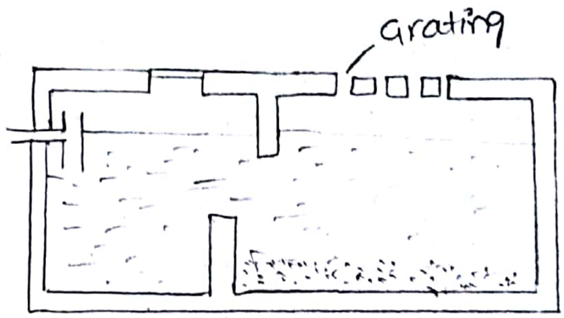
curb inlet



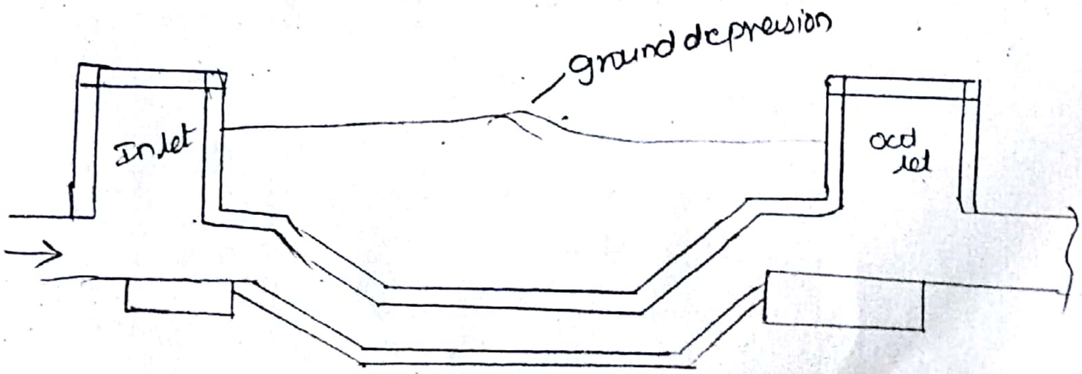
Combined gutter and curb inlet



catch basin



sand, grease and oil traps



Inverted siphon

* Flushing tank
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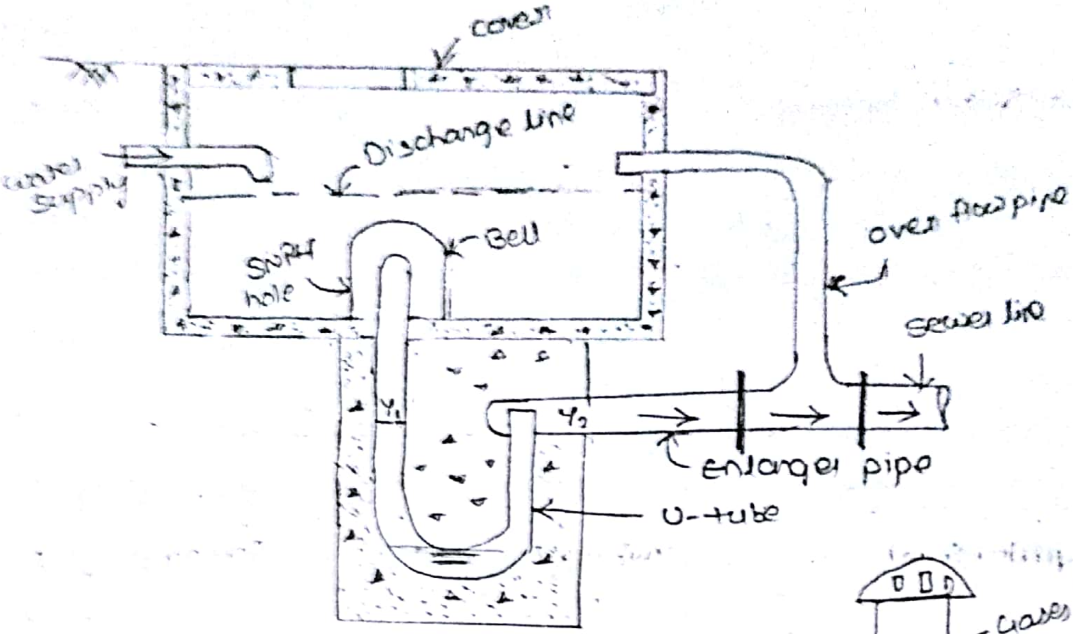
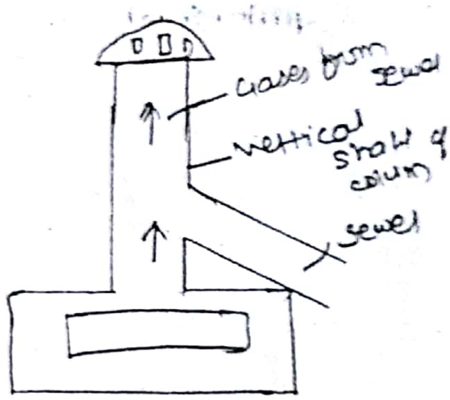
Automatic

Hand operated





Ventilating column

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* cleaning and maintenance of sewer

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Unit - II

Pumping of waste water

Necessity of pump:-

→ Low lying areas

→ Basement

→ Ridges

→ out-fall lift

Location of pumping station:-

→ Topography

→ Elevation

→ Bed rock

6) Types of pumps:-

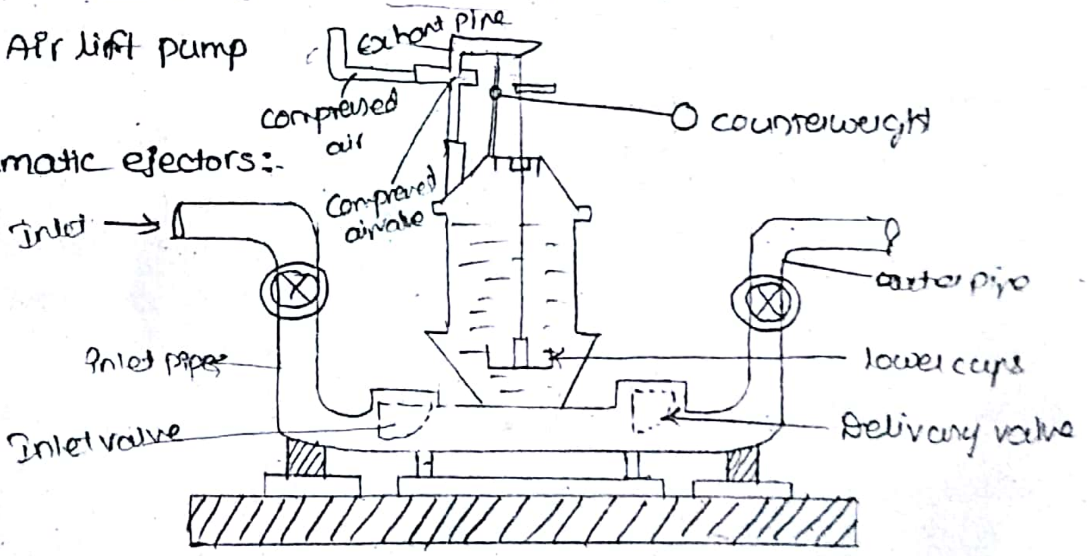
→ centrifugal pumps → it contains impeller → more efficieny, discharge

→ Reciprocating → dust particles is present then it knocks, clogging

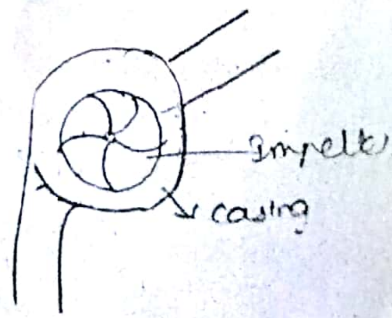
→ peumatic ejectors → For small quantity delivers

→ Air lift pump

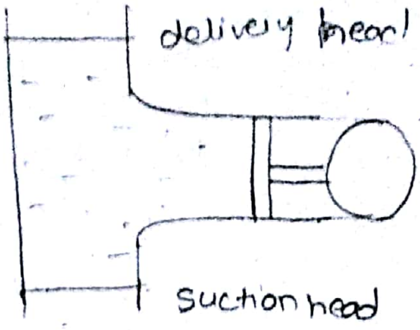
peumatic ejectors:-



centrifugal pumps



Reciprocating pump:-

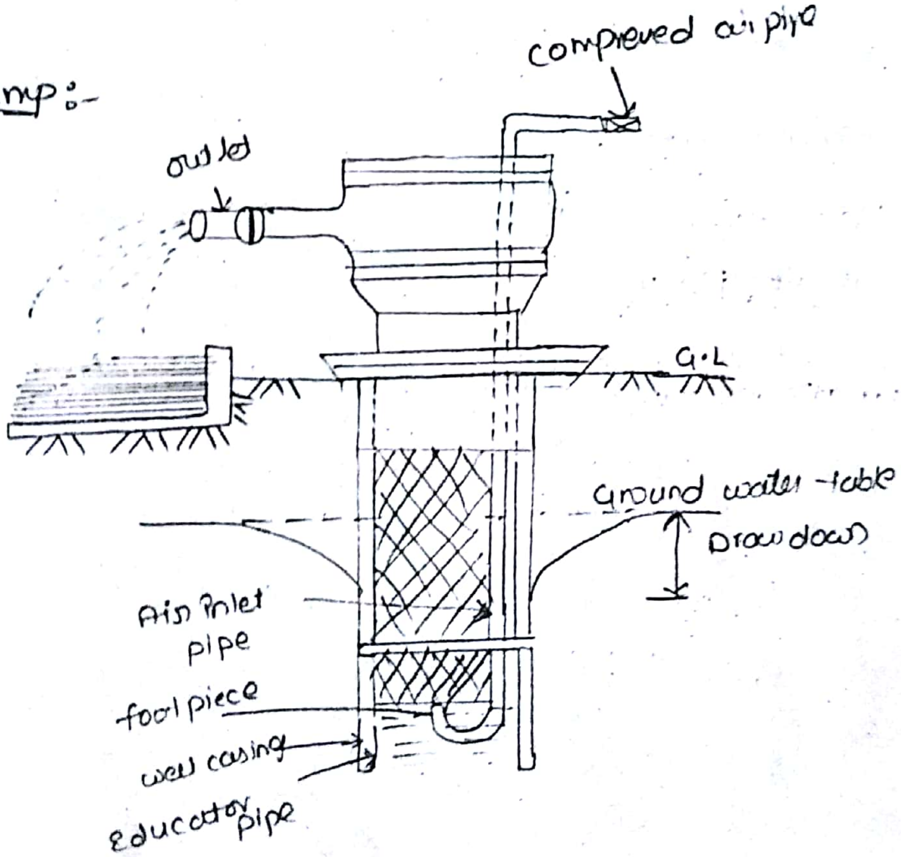


* Advantages of pneumatic ejectors:

→ Automatic, no escape of sewer gases

→ less chance of clogging

Air lift pump:-



→ Works on compressed air

→ No moving parts, Hence more suitable for sewage pumping

→ It consists of vertical pipe called educator pipe

b) Hath's formula

$$Q = 292\ C R i A (S/A)^{1/5}$$

c) Metcalf and eddy's formula

$$Q = 28.32 \left[\frac{25000}{2.47A + 125} + 15 \right]$$

d) Fuller's formula

$$Q = \frac{CM^{0.8}}{13.23}$$

e) Faming's formula

$$Q = 12.8\ M^{5/8}$$

F) Talbot's formula

$$Q = 22.4\ M^{1/4}$$

Q = runoff in m^3/sec

C = runoff coefficient

i = intensity of rainfall in cm/hr

S = slope of the area in metre of thousand meter

A = drainage area in hectares

M = drainage area sq. km

(H/W)

* Determine the design peak flow in m^3/sec for an area of 6.25 sq.km with a density of population of 330 person / hectare. Assume percapita water supply 150 Lpcd and sewage contribution of 70% of water supply

Given data

A = 6.25 km^2 = 6.25×100 = 625 m^2

P = 330 person / hectare

water supply = 150 Lpcd

Scanned by CamScanner

sewage contribution = 70%

peak factor (1.5 to 3) = 2.5

Quantity of water sewage entered into sewer by water flow supply

dry weather flow = $\frac{150 \times 330 \times 625 \times 0.7}{24 \times 60 \times 60}$

Q_1 = 250.65 litres/sec

= 0.25 m^3/sec

1 litre = $10^{-3} m^3$

Design discharge = peak factor × Q_1

= 2.5 × 0.25

= 0.625 m^3/sec

* Design of sewers :-

circular section

sewers are designed to

① Fix the crossection of sewer

② slope of sewer

sewer are designed as open channels through closed conduits are used

For design purpose, formula's used are

a) Continuity equation

$$Q = AV$$

b) Manning's formula

$$V = \frac{1}{n} r^{2/3} S^{1/2}$$

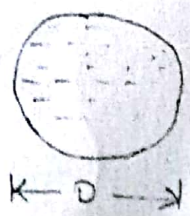
sewer always carry partial flow i.e., empty space is provided inside the sewer to accomodate unexpected un-foreseen, incidental sewage flow. That space can also be used to accomidate gases evolved temporarily

circular geometric cross sections are prefered to other Geometric cross-sections because they are hydrologi- hydrolically more efficient

→ i) sewer are running full :

$$V = C\sqrt{mi}$$

$$V = \frac{1}{n} m^{2/3} i^{1/2}$$



m = hydraulic mean depth

wetted Area $A = \frac{\pi D^2}{4}$

wetted perimeter $P = \pi D$

$$m = \frac{A}{P} = \frac{\pi D^2/4}{\pi D} = D/4$$

ii) sewer are running half full

m = hydraulic mean depth

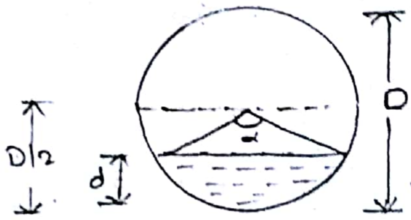
$$A = \frac{\pi D^2}{4} \times \frac{1}{2} = \frac{\pi D^2}{8}$$

$$P = \pi D \times \frac{1}{2}$$

$$m = \frac{A}{P} = \frac{\pi D^2/8}{\pi D/2} = \frac{D}{4}$$

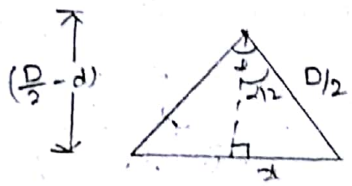
$$m = D/4$$

iii) Partially filled sewer



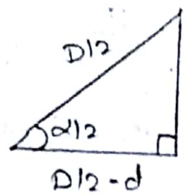
Depth of partial flow

$$d = \left(\frac{D}{2} - \frac{D}{2}\cos\alpha/2\right)$$



Proportionate Depth $= \frac{d}{D}$

$$= \frac{D\left(\frac{1}{2} - \frac{1}{2}\cos\frac{\alpha}{2}\right)}{D}$$



$$= \frac{1}{2}(1 - \cos\alpha/2)$$

$\sin\frac{\alpha}{2} = \frac{x}{D/2}$

$x = \frac{D}{2}\sin\frac{\alpha}{2}$

$$\cos\alpha/2 = \frac{(D/2 - d)}{D/2}$$

$$d = \frac{D}{2} - \frac{D}{2}\cos\alpha/2$$

a = area of flow

= are of sector − area of triangle

$= \frac{\pi D^2}{4} \frac{\alpha}{360} - \frac{1}{2}\left[2\left(\frac{D}{2}-d\right)\left(\frac{D}{2}\sin\frac{\alpha}{2}\right)\right]$ ... n on a

$= \frac{\pi D^2}{4} \frac{\alpha}{360} - \left[\frac{D}{2}\cos\frac{\alpha}{2} \cdot \frac{D}{2}\sin\frac{\alpha}{2}\right]$ ... quivalent ... ty ...

$\left[\sin\alpha = 2\sin\frac{\alpha}{2}\cos\frac{\alpha}{2}\right.$

$= \frac{\pi D^2}{4} \frac{\alpha}{360} - \left[\frac{D^2}{4} \cdot \frac{\sin\alpha}{2}\right]$ $\quad \frac{\sin\alpha}{2} = \sin\frac{\alpha}{2} \cdot \cos\frac{\alpha}{2}$

$= \frac{\pi D^2}{4}\left(\frac{\alpha}{360} - \frac{\sin\alpha}{2\pi}\right)$

...ate area $= \frac{a}{A}$

$= \frac{\frac{\pi D^2}{4}\left(\frac{\alpha}{360} - \frac{\sin\alpha}{2\pi}\right)}{\frac{\pi D^2}{4}}$

$\frac{a}{A} = \frac{\alpha}{360} - \frac{\sin\alpha}{2\pi}$ ... 0.014

0.1492

perimeter $p = \pi D \cdot \frac{\alpha}{360}$ ... pe % ... 0.7905 ... c

$P = \pi D$

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...rtiate perimeter $= \frac{p}{P} = \frac{\pi D \frac{\alpha}{360^\circ}}{\pi D}$

$= \frac{\alpha}{360^\circ}$

...ion depth

$= \frac{a}{p} = \frac{\left(\frac{\alpha}{360} - \frac{\sin\alpha}{2\pi}\right)\frac{\pi D^2}{4}}{\left(\frac{\alpha}{360}\right)\pi D}$

...ing at

...the

$= \frac{D}{4}\left[1 - \frac{\sin\alpha}{2\pi} \times \frac{360^\circ}{\alpha}\right]$

$\frac{A}{P} = \frac{\pi D^2}{4} / \pi D \Rightarrow \frac{D}{4}$

Proportinate Hydraulic mean depth

$$\frac{m}{M} = \frac{\frac{D}{4}\left[1 - \frac{360^\circ \sin\alpha}{2\pi\alpha}\right]}{\frac{D}{4}}$$

$$= \left[1 - \frac{360^\circ \sin\alpha}{2\pi\alpha}\right]$$

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Proportinate velocity

V = velocity

v = velocity of partial flow, $v = \frac{1}{n} r^{2/3} \sqrt{S_0}$ or $\frac{1}{n} m^{2/3} i^{1/2}$

$$\frac{v}{V} = \left[1 - \frac{360^\circ \sin\alpha}{2\pi\alpha}\right]^{2/3}$$

$v = \frac{1}{n} m^{2/3} i^{1/2}$

$V = \frac{1}{n} M^{2/3} i^{1/2}$

$\frac{v}{V} = \left(\frac{m}{M}\right)^{2/3}$

N → constant ; manning's rugosity coefficient

i → constant

$Q = AV$

$$\frac{q}{Q} = \frac{\frac{\pi D^2}{4}\left(1 - \frac{360^\circ \sin\alpha}{2\pi\alpha}\right)^{2/3}}{\frac{\pi D^2}{4}\left(\frac{\alpha}{360} - \frac{\sin\alpha}{2}\right)}$$

Proportinate discharge

$$\frac{q}{Q} = \frac{av}{AV} = \left(\frac{a}{A}\right)\left(\frac{v}{V}\right)$$

$$= \left(\frac{\alpha}{360} - \frac{\sin\alpha}{2\pi}\right)\left[1 - \frac{360^\circ \sin\alpha}{2\pi\alpha}\right]^{2/3}$$

* A 350mm dia sewer is to flow at 0.35 depth on a grade ensuring a degree of self cleaning equivalent to that obtained at full depth at a velocity of 0.8 m/sec. find the required grade

i) Associated velocity

ii) Rate of discharge at this depth

Manning's rugosity coefficient - 0.014

proportionate area - 0.315

proportionate wetted perimeter - 0.472

proportionate hydraulic mean depth - 0.7705

Self-cleansing velocity :- minimum velocity

At full depth, $V = 0.8 m/sec$, $D = 0.35m$ $n = 0.014$

At 0.35 depth ; $\frac{d}{D} = 0.35$, $\frac{a}{A} = 0.315$, $\frac{p}{P} = 0.472$

At full depth $\frac{m}{M} = 0.7705$

$$V = \frac{1}{N} m^{2/3} i^{1/2}$$

$$0.8 = \frac{1}{0.014} (D/4)^{2/3} i^{1/2}$$

$$0.8 = \frac{1}{0.014} \left(\frac{0.35}{4}\right)^{2/3} i^{1/2}$$

$$i = 3.239 \times 10^{-3}$$

now, for a sewer to be the same self cleansing at 0.35 depth as it will be at full depth, we have the gradient required from the equation

$$\frac{S_s}{S} = \frac{M}{m}$$

$$S_s = \frac{M}{m} \times S$$

$$\left(\frac{m}{M} = 0.7705\right)$$

$$S_s = \frac{1}{0.7705} \times 3.229 \times 10^{-3}$$

$$S_s = 4.2 \times 10^{-3}$$

velocity generated at this grade at 0.35 depth is given by equation

$$V_s = \frac{N}{n}\left(\frac{m}{M}\right)^{1/6} \cdot V$$

$$= 1 \times (0.7705)^{1/6} \times 0.8$$

$$= 0.765 \text{ m/sec}$$

now, discharge

$$q_s = a v_s$$

$$= \frac{\pi}{4}(0.35)^2 \times 0.315 \times 0.765$$

$$= 0.023 \text{ cumec}$$

$$\frac{a}{A} = 0.315$$

$$a = 0.315 \times A$$

*** Q

Determine the size of circular sewer for a discharge of 800 lit/sec running half-full. Assume hydraulic gradient of 1 in 1250 and in mannings coefficient $n = 0.012$, ~~Q = 800 litre~~

$n = 0.012$

$Q = 800$ lit/sec

$= 0.8 \text{ m}^3/\text{sec}$

$$Q = AV$$

$$V = \frac{1}{n} m^{2/3} i^{1/2}$$

$$= \frac{1}{n} (D/4)^{2/3} i^{1/2}$$

$$= \frac{1}{0.012} \left(\frac{D}{4}\right)^{2/3} \left(\frac{1}{1250}\right)^{1/2}$$

$$\Rightarrow Q = AV$$

$$\Rightarrow 0.8 = \left[\frac{\pi}{4} (D)^2\right] \left[\frac{1}{0.012} \left(\frac{D}{4}\right)^{2/3} (0.028284)\right]$$

$$\Rightarrow 0.4321 = D^2 \left(\frac{D}{4}\right)^{2/3}$$

$$\Rightarrow 0.4321 = D^2 \, D^{2/3} . (0.3968)$$

$$\Rightarrow 1.0889 = D^{8/3}$$

$$\Rightarrow \boxed{D = 1.03 m}$$

* A RCC sewer of 500mm diameter is layed at a slope of 1 in 750 using Kutter's equation for calculating C chezys equation. Find the velocity and discharge

$n = 0.012$

Kutter's equation

$$C = \left(\frac{23 + \frac{155 \times 10^{-5}}{i} + \frac{1}{n}}{1 + \left(23 + \frac{155 \times 10^{-5}}{i}\right) \frac{n}{\sqrt{m}}} \right)$$

$n = 0.012$

$D = 500mm = 0.5m$

$i = \frac{1}{750}$

$m = \frac{D}{4} = \frac{0.5}{4} = 0.125m$

$$C = \frac{23 + \frac{155 \times 10^{-5}}{(1/750)} + \frac{1}{0.012}}{1 + \left(23 + \left(\frac{155 \times 10^{-5}}{1/750}\right)\right) \frac{0.012}{\sqrt{0.125}}}$$

$$C = \frac{107.4958}{1.82010}$$

$$C = 59.06$$

$$V = C\sqrt{mi}$$

$$= 59.06\sqrt{(0.125)(1/750)}$$

$$= 0.762 \text{ m/sec}$$

$$Q = AV$$

$$= \frac{\pi}{4}(0.5)^2(0.762)$$

$$= 0.149 \text{ m}^3/\text{sec}$$

* **Self cleansing velocity:-**

The minimum velocity at which no Solids get deposited at the bottom of sewer invert of sewer

$$V_s = \sqrt{\frac{8K}{f}(s-1)gd}$$

d → diameter of particles

K → character of Sediment

f → frictional factors

s → specific gravity of particles

g → acceleration due to gravity

→ Air inlet pipe is lower in the In the educator pipe

→ Top end of air inlet pipe is connected to air compressor

→ compressed air is released throughout the air diffuser which is at bottom of inlet pipe

→ Air is mixed with sewage and forms bubbles and foams having low specific gravity than sewage, Hence the sewage inside the educator pipe gets lifted up as the density is less

→ Low efficiency

→ can lift upto small heights only

* Types of pumping stations:-

Pumping stations are provided with two separate wells

① wet-well for receiving the incoming sewage

② Dry well for installing the pumps

These are 3 types for providing well

→ circular with central dry well and peripheral wet well

→ Rectangular with dry and wet wells adjacent to each other

→ circular with dividing wall to separate the dry and wet well

13/11/18

* components of pumping system:-

① structure of pump house

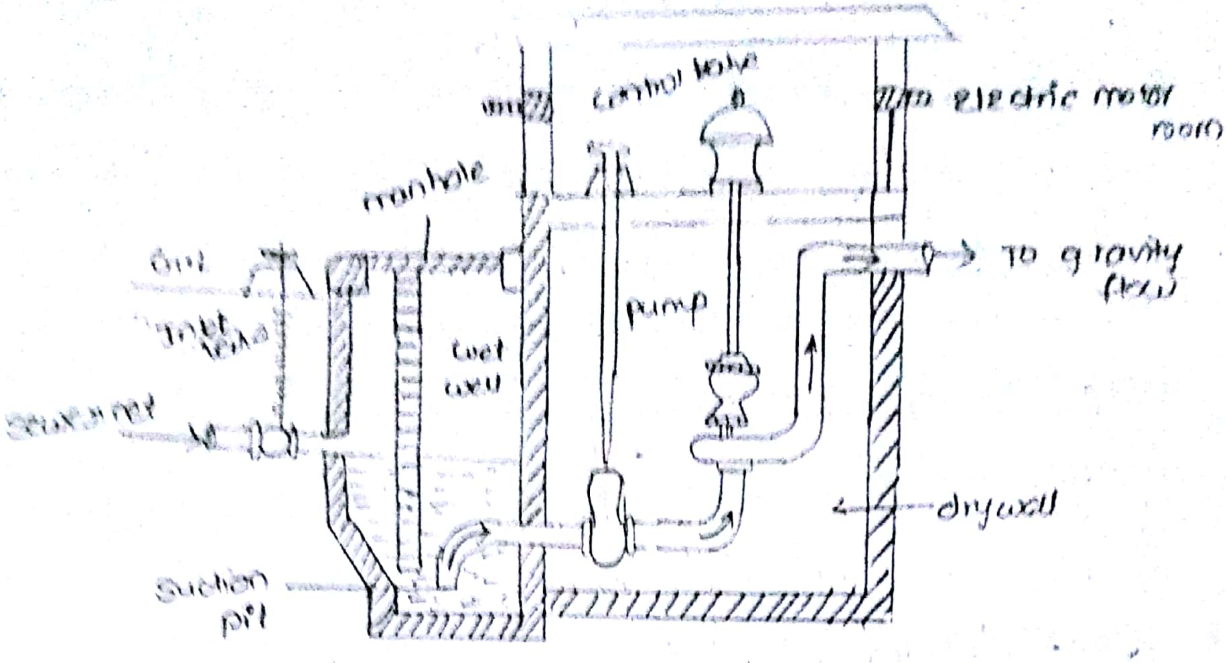
② screening & Grit chamber

③ wet well / sump well

④ drywell / pump room

⑤ pumping with driving engine

⑥ pipes, valves & fitting



Design period → 30 years

① **Structure of Pumphouse :-**

→ It should withstand the forces of floatation.

→ Site should not be flooded

→ Dry and wet wells should be of R.C.C structure

→ Design for 30 years

→ While designing pumphouse provisions should be made for easy removal and installation of pumps and motor

② **Screening and grit chamber :-**

→ Removal of sand, gravel, wood etc., from sewage before letting it to pumping station. or, else, there would be wear and tear of machinery

→ Through screens floating matter is removed and in grit chambers heavier inorganic solids get settled down

③ **Wetwell / Sumpwell :**

→ Sewage from city is reached ~~from~~ at pumping station in a tank called sump or wetwell

→ capacity :- It can store for atleast 2 hours dayworld flow

→ present days tank having a capacity of 20 to 30 min is sufficient

→ It is placed at the level than sewage from trunk sewers flows into it by gravity

→ Gate walls to stop sewage flow during inspection

④ **Pump room / Dry well :-**

→ place where pumps are installed

→ size of dry well should be sufficient more numbers of pumps in the future

→ under ground masonary or RCC having circular or Rectangular shape in plan

→ provide indeep these wells. so that priming doesnot takes place

→ usually pumps are not located in wet wells

⑤ **pumping with driving engine (or) motor :-**

→ In the drywell above the sewage level. in the wetwell

→ pumps can be directly coupled to driving units

(C) Pipes, valves & fittings :-

→ CI pipes are to be provided

→ size of pipes to maintain flow velocity of 0.6 to 0.9 m/sec

→ no of valves bends should be less to prevent losing head

→ check valves to be provided in the sewer line to prevent the back flow of sewage during floods

19/7/17

* House drainage

→ Arrangements provided in a house or building for collecting and conveying waste water flow to drain pipes by gravity to join either a public sewer or domestic septic tank is called house drainage

→ Aim is to maintain health conditions to dispose the waste as early as possible

principles of house drainage:-

→ Minimum length of pipes are used

→ The drainage pipe of multistorey building is provided as a single pipe out of the building

→ self cleansing velocity must be followed

→ traps are used in sanitary pipes

→ Minimum types of traps must be provided

* sanitary fittings:-

→ Wash basin
  - → Angle back - for fixing at junction of 2 walls
  - → Flat back - for mounting on wall

→ Sinks

→ Bathtubs

→ flushing cisterns

→ water closets

→ urinals

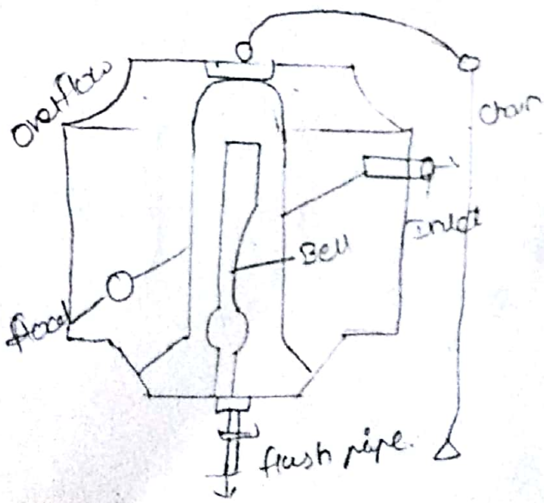
Flushing cisterns :-

→ Flushing cisterns are used for flushing out water closets and urinals.
They are made of cast iron for Indian type water closets,
cast iron flushing cistern is normally used, fixed at
about 2m above the floor level.

→ For European and Anglo Indian type water closets
procelain cisteins are normally used, fixed at about
60 cm above floor level

→ Flushing cisterns are two types
1) valveless siphonic type
2) valve fitted siphonic type.

Bell type flushing cisterns:-



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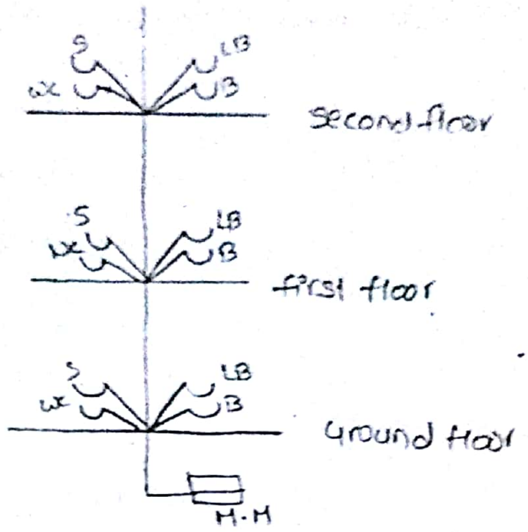
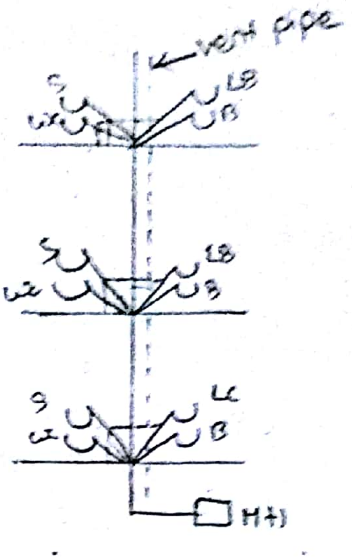
20/7/17

* Systems of plumbing :-

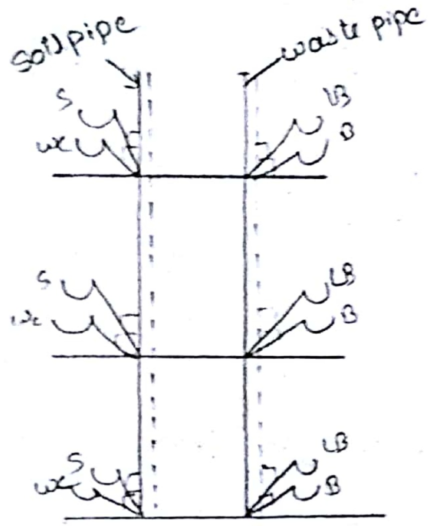


single stack system

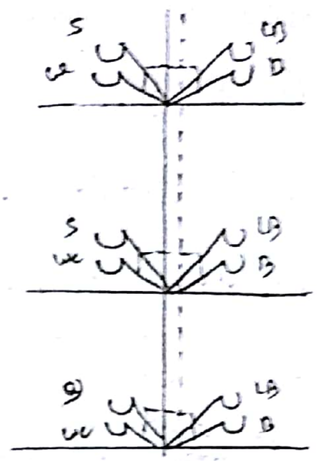


partially

S → sink
WC → water closet
LC → lavatory basin
B → Basin
MH → manhole



Two pipe system



single pipe system