

# Theory Questions

DATE: / /  
PAGE: / /

- ① What is coagulant? what is coagulation, write adv & dis.adv.

→ Coagulant is a chemical substance used in ~~waste~~ WW Treatment to remove suspended particles by promoting their aggregation into large clumps (flocs). ex-Alum,  $\text{FeCl}_3$ .

Coagulation is the process of adding a coagulant to water to destabilize suspended particles. These particles are usually -vely charged & repel each other, preventing settling.

Adv-

- ① Effectively removes suspended solids & colloidal particles.
- ② Enhances removal of bacteria & other pathogens.
- ③ Produces clean water by removing turbidity.

Disadv-

- ① Produces significant qty. of sludge that require proper disposal.
  - ② Requires careful handling & storage of chemicals, which is hazardous.
  - ③ Effectiveness depends on pH, & requires careful control.
- ② Why Coagulant is used in Sewage treatment plant?
- ① ~~Coagulant~~ Coagulant helps aggregate fine suspended particles that are difficult to remove by simple sedimentation.

② Coagulation significantly reduces turbidity, improving the clarity of treated water.

③ By removing suspended solids, coagulant indirectly reduce microbial load since many pathogens adhere to these particles.

④ Coagulant aid in the removal of org. compound, including those that contribute to BOD & COD.

⑤ ~~By reducing suspended solids, coagulant indirectly reduce microbial load since many pathogens adhere to these~~

Chem. Coagulants, particularly aluminium & Iron salts can precipitate phosphates, helping control nutrient pollution & preventing eutrophication.

③ Imhoff tank. Adv & Disadv-

→ It is 2-storey sedimentation & digestion tank used in sewage treatment. It combines primary sedimentation & anaerobic digestion in single storey, primarily for smaller treatment plants.

Adv-

① Combines sedimentation & digestion in one unit, saving space.

compared

② Economical to build & operate, to separate units.

③ The enclosed digestion zone minimizes odour

release.

Disadv-

- ① Suitable for smaller plants, not efficient for large sludge treatment.
- ② Requires longer time for sludge digestion, reducing processing speed.
- ③ Not as effective as in removing dissolved organic or pathogens as advanced systems.

④ Self Cleaning velocity?

→ It is the minimum flow velocity in sewer or pipeline required to prevent the deposition of suspended solids and ensure continuous movement of sediments. This velocity helps in maintaining the pipeline's functionality & prevents blockage.

It prevents blockage, reduces maintenance cost, maintains hydraulic efficiency, controls odour formation.

Factors affecting Self-Cleaning velocity:

- ① Solid concentration & particle size.
- ② Rough surfaces & steeper slopes aid in achieving higher velocities.
- ③ Peak flow helps achieve self-cleaning condition.

⑤ Manholes & their fun.

→ Manholes are vertical access points to underground

Utility networks like sewage systems, storm drains or electrical conduits. Typically covered by metal or concrete lid, they allow maintenance personnel to inspect, clean & repair these systems.

Qn:-

- ① Provides access to inspect & clean underground pipelines.
- ② Help release gas from sewers, reducing pressure build up.
- ③ Allows monitoring & control of wastewater or stormwater flow.
- ④ facilitates repair & replacement of underground infrastructure.
- ⑤ Used at junction where pipelines change direction or meet.

### ⑥ Deep holes & their fn.

→ Deep holes / Deep manholes are special type of manholes used in sewer system where there is a significant difference b/w elevation b/w connecting pipes.

fn:-

- ① Safely lowers sewage from a higher to lower level within.
- ② Reduces velocity & minimizes the impact of high-speed flows, preventing erosion & pipe damage.

- ⑥ Maintains smooth flow by managing pressure & energy loss in steep areas.
- ⑦ Helps trap gases by limiting free-flow air exchange.

## ⑧ BOD & COD -

### BOD

① Am't. of O<sub>2</sub> req. by micro-organisms to decompose organic matter biologically.

② Test duration is 5 days at 20°C.

③ Measures Biodegradable Organic Matter

④ Value is lower than COD for the same sample.

### COD

① Am't. of O<sub>2</sub> req. to chemically oxidise both ~~bio~~ Biodegradable organic matter.

② 2-3 hrs.

③ Total Organic matter (Bio & non-bio degradable)

④ Higher than BOD for the same sample.

## ⑨ UASB - (Upflow Anaerobic Sludge Blanket) -

→ It is a reactor in WW treatment technology that utilizes anaerobic digestion to treat high-strength org. CW.

Converts Anaerobic bacteria convert org. matter into Biogas. Promotes natural settling, with treated water exiting at the top. Biogas

produced can be harnessed for electricity or heating.

Adv -

- ① Efficient for high org. load.
- ② Low energy requirement
- ③ Produces valuable Diodes.

⑨ Clean out -

→ Clean-outs are access points in sewer and drainage systems, typically capped pipes or openings that provide entry for cleaning and maintenance.

fn:-

- ① Allows plumbers to remove blockages or debris using rods or hydro-jetting tools.
- ② Enable easy inspection of sewer line for clogs or damage.
- ③ Help ensure smooth flow by enabling regular maintenance.

⑩ Lamp hole -

→ Lampholes are small vertical openings in sewer systems, primarily used for inspection and maintenance, especially in smaller or less accessible pipelines.

fn:-

- ① Provide a pt. to insert a lamp or light for visual inspection of the sewer line's end.

- ① Limited cleaning allows minor cleaning or blockage removal using rods.
- ② Facilitate air circulation within the sewer to prevent gas build up.
- ③ Serve as an economical alt. to fill manholes in smaller pipelines.

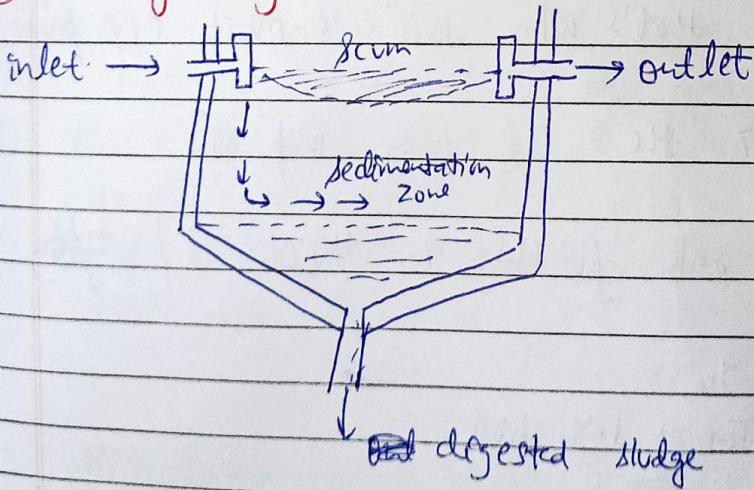
### 11 Street Inlets (Gullies) -

→ Street Inlets or gullies are drainage stor. located along roads & streets designed to collect surface runoff and direct it into stormwater or combined sewer system.

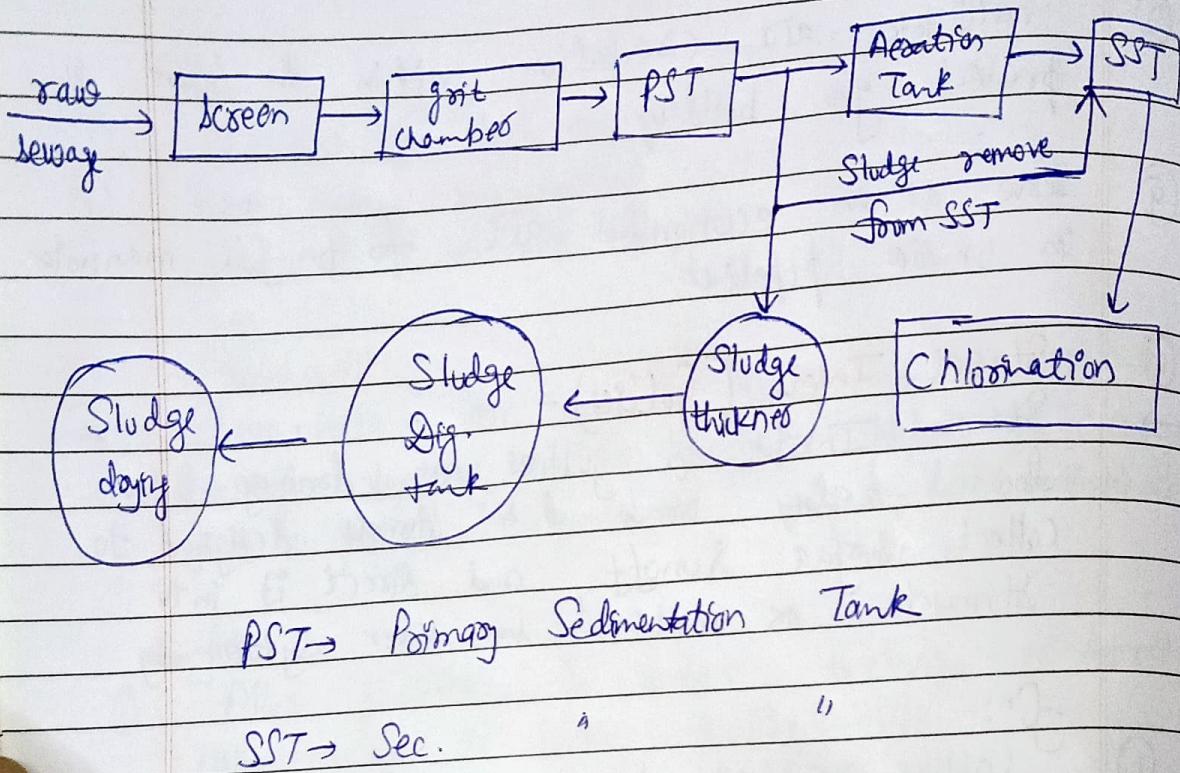
fn:-

- ① Capture rainwater, preventing flooding on roads.
- ② Include grates or traps to block debris from entering drainage system.
- ③ Ensure quick removal of standing water.
- ④ Guide water efficiently into underground pipelines or storm drains.

### 12 Sludge Digestion Tank -



## (B) Secondary Treatment through activated Sludge Process -



① The sewage effluent from PST, which is thus normally utilised in this process is mixed with 20-30% of own volume of Activated Sludge.

② Remove upto 80-95% of BOD, Bacteria upto 90-95%. That's why this is most eff. process.

③ for AST the O<sub>2</sub> play imp role,

④ Overflow rate for AST is 40,000 l/m<sup>2</sup>/day

⑤ Depth → 2-4m

Retention Time → 1.4 hrs

⑥ Q-method for introducing air into one aeration tank.

- Diffused air aeration / air diffusion.
- Mech. Aeration

& sometime used both & called combined Aeration.

(14) Conv. & High rate TF-

Conventional

① Depth ps 1.6m - 2.4m

② Size of filter media  
25 - 75mm.

③ More area req.

④ QOD  $\leq$  20 ppm

⑤ Recirculation not provided.

⑥ Dosing interval b/w  
3-10 min

High Rate.

① b/w 1.2 - 1.8m

② 25-60mm

③ Less area.

④ QOD  $\geq$  30 ppm

⑤ Provided.

⑥ not more than 15 sec.

(15) ASP

→ Poolless ps for suspended growth.

→ Aerated tank where microorg. break down org. matter

→ High QOD & nutrient removal efficiency.

TF

→ for attached growth

→ Waste water trickles over a bed of microbial-covered media.

→ Moderate QOD removal, less eff.

- High cost due to energy needs.
  - req. more space, but can handle larger flow.
  - req. skill labour.
- } → Low operating cost.
- compact, suitable for smaller flows or rural areas.
- less maintenance

(16)

Screener & its types

It is the first operation carried out at a sewage treatment plant of passing of the sewage thru diff. type of screens.

Types-

① Coarse screen-

→ Also called racks.

→ Spacing 50mm or more.

→ help in removing large fleshy obj.

→ collect 6 lit. of solid / million lit. of sewage.

②

Medium -

→ Spacing f - 40 mm.

→ collect 30 - 90 lit / million lit. of sewage.

③

fine -

→ 1.5mm - 3 mm

→ at 30 - 60° angle

→ vel. 0.8 - 1 m/s

## (A) Objective of Poi, Test, der. Treatment.

### ① Primary -

→ Primary treatment consists in removing large suspended org. load. This is usually accomplished by sedimentation in settling.

### ② Sec. -

→ This is generally accomplished thru. Biological decomposition of org. matter which can be carried out either under aerobic / anaerobic condn. in which org. matter decomposed by aerobic bacteria are known as aerobic biological unit.

It consists of:

① filters

② Aeration tank

③ Oxidn pond & associated lagoons.

### ③ Inhoff (part of septic tank)

### ④ Complete final treatment -

→ This treatment consists in removing of org. load left after secondary treatment & to kill pathogenic bacteria carried out chlorination. To make safe for drinking.

### ⑤ Grit chamber, construction & diagram

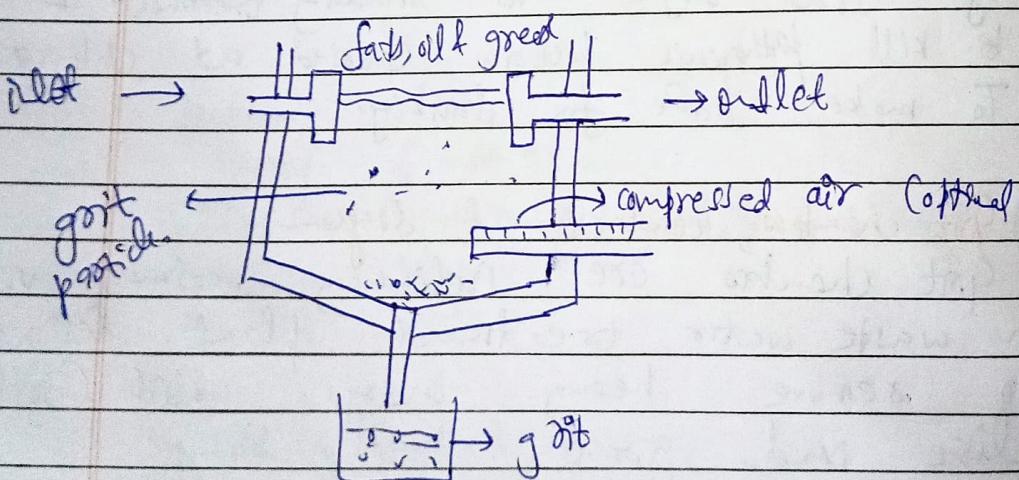
→ Grit chambers are preliminary treatment unit in waste water treatment plant designed to remove heavy org. load (grit) like sand, gravel & small stones.

Construction:-

- Rectangular, square/circular
- WW enters at one end & exit at other allowing steady flow
- 20-60 sec detention time
- Vel. 0.3 m/s to prevent settling of org. matter while allowing grit to settle
- Settled grit is collected at bottom & removed manually/mechanically.

### Principle:

- Grit chamber work on the principle of sedimentation. Heavier org. particles settle at bottom due to gravity, while lighter org. matter remains suspended.
- The flow vel. is controlled so that only the heavier grit particles settle properly.



(1)

## Combine Sewer

- Carries both Stormwater & domestic WW in a single pipe.
- Simple, fewer pipes to install & maintain.
- Lower initial cost but high operational cost.
- Can cause pollution if untreated overflows reach water bodies.
- Preferred in older cities with old infrastructure.

## Separate Sewer

- Carries Stormwater & wastewater in separate pipes.
- More complex, req. two I/I network.
- High initial cost, but more efficient in dry-weather operation.
- Less pollution risk since Stormwater bypass treatment plants.
- Preferred in modern urban development & new installations.

(2)

## Septic tank -

