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Mid-Term Paper

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Q1 What is Wastewater Engineering? Briefly describe its applications in Safeguarding the environment?

Ans Wastewater Engineering :- also Known as Sanitary engineering or Public health engineering, in which the basic principles of science and engineering are applied to solving the issues associated with the treatment and reuse of wastewater. The ultimate goal of wastewater engineering is the protection of Public health in a manner commensurate with environments, it is necessary by economic, social, and political concerns. To protect public health and the environment, it is necessary to have knowledge of

1. Constituents of Concern in Wastewater.
2. Impacts of these constituents when wastewater is dispersed into the environment.
3. The transformation and long term fate of these

Constituents in treatment processes.

4. Treatment methods that can be used to remove or modify the constituents found in wastewater.

5. Methods for beneficial use or disposal of solids generated by the treatment systems.

To provide an initial perspective on the field of wastewater engineering, common terminology is first defined followed by,

A. A discussion of the issues that need to be addressed in the planning and design of wastewater engineering.

B. The current status and new directions in wastewater engineering.

Wastewater Engineering applications in Safeguarding the environment :-

1. By disposing off treated wastewater in order to reduce ground water contamination and protect aquatic life.

2. Wastewater Engineering deals with the management of wastewater and its treatment to reuse it for various purposes.

3. The recovery of sewage is an effective means of saving water resources and promoting the reuse of water resources.

4. Primary objectives of wastewater engineering is to provide a good sanitary environmental condition in a city.

=> It is an important measure to reduce the pollution of sewage and protect the environment.

Q2. Briefly describe the relationship of wastewater generation with water supply of a locality?

Ans The relationship of wastewater generation with water supply of a locality is that;

1. In situations where wastewater flow rate data are limited or unavailable wastewater flow rate estimate have to be developed from water consumption records in other information.

2. About 60-85% of supplied water per capita becomes wastewater.

3. Simply wastewater generated is dependent on supplied water. As increase, the waste water will be more.

Water supply of a locality means the inflow of a city water to your property.

=> Wastewater generation is the outflow of sewage from your property that will eventually end up in the sewage system.

=> Wastewater is any water that has been contaminated by human use. Wastewater is "used water from any combination of

domestic, industrial, commercial or agricultural activities, surface runoff or stormwater, and any sewer inflow or sewer infiltration.

=> Municipal wastewater is mainly comprised of water (99.9%) together with relatively small concentrations of suspended and dissolved organic and inorganic solids.

=> Fresh water is generally produced on board using the evaporation method. There are two things that are available in plenty on ship to produce fresh water.

=> Thus fresh water is produced by evaporating sea water using heat from any of the heat source.

Q3 What is the importance of wastewater characterization?

Ans Importance of Wastewater characterization :-

A characterization of the wastewater, which provides a wide variety of information regarding the type and concentration of the contaminants present, must be carried out to determine the type of contamination concerned. In addition to general parameters such as pH and conductivity, the parameters that should be analyzed are those that give an idea of the content of organic matter, nutrients (nitrogen and phosphorus), solids in suspension, the toxicity of the wastewater as regards micro-organisms, in addition to more specific parameters related to the type of

activity generated by the effluent (metals, surfactants, sulfates, cyanides, etc).

A characterization of wastewater provide a wide velocity of information regarding the type and concentration of contamination present. With characterization of wastewater, we determine the nature of contaminants (Physical, chemical and then design wastewater treatment plant according to the nature of contaminants).

=> Whenever a major wastewater flow needs to be treated, the first alternative that should normally be considered is the use of a biological process as this is

one of the cheapest complete treatments and the amount of waste generated is relatively low. However, the nature of the contamination present in the water must determined in order to evaluate the suitability of one treatment over another as they tend to be highly selective as regards the type of contamination eliminated.

=> To determine the quantity of organic matter that microorganisms are able to assimilate, the biochemical oxygen demand (BOD5) has been widely used to characterize wastewater, although this parameter is somewhat imprecise.

However, precisely because it measures all the organic matter, the information provided is necessary but not sufficient for a better understanding of the effluent to be treated. Similarly, determination of the various fractions on the basis of their differing biodegradability also allows the kinetic models that will subsequently describe the behavior of the system (effluent quality, oxygen demand, sludge production, etc), in response to real-time fluctuations in effluent load and flow to be calibrated.

⇒ As such, complete characterization of the

=> Wastewater is essential in order to be able to undertake the treatment type selection step and its subsequent design, with a guarantee of success.

Q4 Enlist physical, chemical and biological characteristics of wastewater?

Ans Physical characteristics :-

1. Solids
2. Odor
3. Temperature

1. Solids :- Solids are classified into three main types.

i. Total solids :- All the matter that remains as residue upon evaporation at 103°C to 105°C.

ii. Setteable solids :- are measured as ml/L, which is an approximate measure of the sludge that can be removed by primary sedimentation.

iii. Suspended solids : (SS) and Filterable solids : (FS).

2. Odor :-

is proposed by gas production due to the decomposition of organic matter or by substances added to the wastewater.

Detection of odor :-

is measured by special instruments such as the portable H_2S meter which is used for measuring the concentration of hydrogen sulfide.

3. Temperature :-

of wastewater is commonly higher than that of water supply. Depending on the geographic location the mean annual temperature varies in the range of 10 to 21°C with an average of 16°C.

Importance of temperature :-

affects chemical reactions during the wastewater treatment process. Affects aquatic life. Oxygen solubility is less in warm water than cold water. Optimum temperature for bacterial activity is in the range of 25°C to 35°C.

Density :- almost the same density of water the wastewater doesn't include significant amount of industrial waste.

Color:

→ Fresh waste water — Light brownish gray.

→ With Time — Dark gray.

→ More Time — Black (septic).

→ Sometime pink due to algae or due to industrial colors.

Turbidity: it's a measure of the light-transmitting properties of water.

Chemical characteristics of Wastewater:-

1. Organic matter
2. Inorganic matter
3. Gases
4. PH

1. Organic matter :-

Organic matter is derived from animals & plants and man activities. ($C_a H_b O_c$).

Measurements of organic matter:

→ Biochemical oxygen demand (BOD).

→ Chemical oxygen demand (COD).

→ Total organic carbon (TOC).

→ Theorchical oxygen (ThOD).

2. Inorganic Matter :-

→ Chlorides :
high concentrations include that the water body has been used for waste disposal.

→ Phosphorus : Municipal waste contains (4 - 15 mg/l).

→ Sulfur :
Sulfate exists in waste and necessary for synthesis of proteins.

$$\text{Organic matter} + SO_4^{-2} \rightarrow S^{-2} + H_2O + CO_2$$

$$S^{-2} + 2H^+ \rightarrow H_2S$$

→ Toxic inorganic Compound :
Copper, lead, silver, chromium, arsenic, boron.

→ Heavy metals :
Nickels, Mn, lead, chromium, cadmium, zinc, copper, iron.

3. Biological characteristics :-

The environmental engineer must have considerable knowledge of the biological of waste water because it is very important characteristics factor in waskwater treatment.

→ The principal groups of microorganism found in wastewater.

→ The pathogenic orgenisms.

→ Indicator organisms (indicate the presence of pathogens).

→ The methods used to amount the microorganisms.

→ The methods to evaluate the toxicity of treated wastewater.

→ The main microorganisms of concern in wastewater treatment are,

-> Bacteria

-> Fungi

-> Algae

-> Protozoa

-> Viruses

-> Pathogenic.

Q5 What are the advantages and disadvantages of combine and separate sewage system? Which sewage system will you recommed for a new proposed township, Support your answer with justification?

Ans **Separate Sewage System :-** In this system the sanitary sewage and storm water are carried separately in two sets of sewers. The sewage is conveyed to wastewater treatment plant and the storm water is discharge directly into rivers without treatment. The separate system has the following advantages & disadvantages.

Advantages :-

1. The load on treatment plant is less as only sewage is carried to the plant.
2. The size of sewers are small thus economical.
3. When pumping is required the system process to be economical.

4. Natural water is not unnecessarily polluted by sewage.

Disadvantages :-

1. Cleaning of sewers is difficult due to their small size.
2. The maintenance costs are high.
3. The self cleaning velocity is not easily achieved.
4. The storm sewers come in operation in rainy season only.
5. The may be chocked in during dry season by garbage.
6. The separate system is suitable when separate outlets for storm water is available and the topography is such that storm water can be dispose off in natural drains.

Combine Sewage :-

In this system the sewage and storm water are carried all together in only one set of sewers to the wastewater treatment plant before disposal. This system has the following advantages and disadvantages.

Advantages :-

1. It is easy to clean combine sewers because of large size.
2. The maintenance cost is reasonable.
3. It reduces strength of sewage by mixing storm water with sewer.
4. The system requires one sewer making it economical.

Disadvantages :-

1. In storm seasons water may overflow and the sewers may damage causing serious health risks.
2. The combine sewer gets silted and becomes foul in dry days.
3. The load on treatment plant is high because storm water is also carried there.
4. The storm water gets polluted unnecessarily.
5. The system is uneconomical when pumping is need. The system is suitable when space available for laying two sets of sewers is less and when pumping is not required.

Sewage System recommended for a new proposed township :-

I will propose combined sewage system for a new township because both domestic sewage and sewage water are carried in a single sewer so construction cost is less and sewer are of large size so they are easy to clean.