Drainage System

A drainage system is a group of interconnected pipe networks that collect wastewater from its source and reach its disposal. The term drainage can also be correlated with irrigation engineering. This is an important concept of the GATE CE syllabus. A drainage system also refers that draining out the excess water from the soil to ensure the proper growth of the plants.

The main purpose of providing the drains is to ensure the proper collection of wastewater. If drainage systems are not installed properly, it may lead to the growth of unhygienic organisms. For the good health of human beings, drainage systems should be designed properly and ensure their maintenance.

Types of Drainage Systems

A drainage system can be classified based on how it drains the water and its requirement. Here a few types of drainage systems are explained based on their roles. It can be classified mainly into 4 types.

- Surface Drainage System
- Subsurface Drainage System
- Slope Drainage System
- Downspouts and Gutter System

Surface Drainage System

This system of draining the water is used to drain out the surface water. Surface water is generally generated from the rainfall in the area. Sometimes, a channel is created to carry the water from one place to other for their requirement.

Subsurface Drainage System

Subsurface drain systems or the French drain are laid off beneath the top layer of the soil. It is used to drain out excess water available in the below layer of the topsoil.

Slope Drainage System

Slope drainage systems are constructed on a particular slope. It is used to drain out the water in a downward direction based on the action of gravity.

Downspouts and Gutter System

These drainage systems are generally used to collect the water from its generation points and reach out to the main pipeline of the drainage system. Sometimes, it may connect to the underground drains with the help of gutter drains.

Characteristics of the Good Drainage System

The drainage system for an area should be designed properly, and it should be designed in such a way that it can be used with maximum efficiency. These characteristics of the drainage system are essential for the GATE CE exam. Here a few characteristics of a good drainage system are given below.

- A drainage system should be located in such a way it collects water from all ends.
- It should be durable so that installation and maintenance costs can be justified.
- A drainage system should have a main pipe to regulate in all directions.
- The size of pipes in a good drainage system should be such that it attains self-cleansing velocity at all times.
- A good drainage system should have proper cleaning facilities at all locations.

What is Leaching Water?

Leaching water is a type of wastewater generated from the decomposition of biodegradable waste after a certain period of time. leaching water contains harmful contaminants, soluble fertilizers, etc. leaching water is generated with the water and the contaminants of the biodegradable wastes.

Leaching Requirement (L.R)

$$\mathbf{L.R. = D_d/D_a = C_i/C_d = (E.C)_i/(E.C)_d}$$

Where

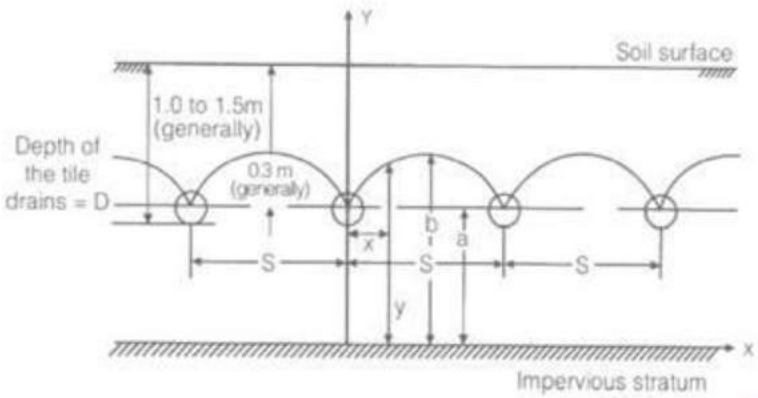
- D_d = Depth of water drained out per unit area
- D_a = Depth of water applied per unit area
- C_i = Salt content of irrigation water
- C_d = Salt content of drained water
- $(E.C)_i$ = Electrical conductivity of irrigation water
- $(E.C)_d$ = Electrical conductivity of drained water.

Depth and Spacing of Tile Drains in Drainage System

Tile drains are generally used to drain the water in the agriculture drainage system. Tile drains are used in humid or semi-humid agricultural fields. Questions based on Tile drains are asked in the GATE exam. Sometimes, tile drains can be sued for subsurface

drainage purposes in agricultural fields. Here formula for the depth and spacing of tile drains are explained below.

$$S = (4k)(b^2 - a^2)/q$$



Where

- S = Spacing of tile drains in m
- k = Coefficient of permeability in m/s
- q = Total discharge per unit length of tile drain $m^3/s/m$
- b = Height of the water table above the impervious layer
- a = depth of impervious stratum below the center of the drain

$$q = (P/100)(Sl)/(24\times3600)$$

Where P = Annual rainfall in meters at a place.