

ENGINEERING HYDROLOGY AND WATER MANAGEMENT

MODULE # 01

Hydrology:-

- * The study of water in all its forms (rain, snow and water on the earth surface) and from its origins to all its destinations on the earth is called Hydrology.
(Chambers Science and Technology Dictionary)
- * The study of water in all its forms, and from its origins to all its destinations on the earth. (Bras, 1990)
- * The Science dealing with the waters of the earth, their occurrence, distribution and circulation, their chemical and physical properties, and their interaction with environment
(Ward and Robinson, 1999).

Scope of Hydrology:-

- * Water is one of the most valuable natural resources essential for human and animal life, industry and agriculture.
- * Used for power generation.
- * Development and management of water resources for irrigation, water supply, flood control, water-logging and salinity control and navigation.

Salinity:- Salinity is the measure of all the salts dissolved in water.

water logging:- Saturation of soil with water.

Why Hydrology is Studied:-

Water is one of our most important natural resources. Without it, there would be no life on earth.

The supply of water available for our use is limited by nature - Although there

is plenty of water on earth, but it is not always in the right place, at the right time and of the right quantity.

Practical uses of hydrology (Applications)

In hydrology we apply scientific knowledge and mathematical principles to solve water-related problems in society: problems of quantity, quality and availability - Mathematical of all hydrological phenomena are made.

They may be concerned with finding water supplies for cities or irrigated farms, or controlling river flooding or soil erosion.

- ① Hydrology is used to find out maximum probable flood at proposed sites eg Dams.
- ② The variation of water production from catchments can be calculated and described by hydrology.
- ③ It helps us to know the required reservoir capacity to assure adequate water for irrigation or municipal water supply in

drought condition.

- ④ Used in connection with design and operations of hydraulic structure.
- ⑤ Hydrology is the basic tool in planning and building hydraulic structures.
- ⑥ Hydrology is used for city water supply design which is based on catchment area, amount of rainfall, dry period, storage capacity, runoff, evaporation and transpiration.
- ⑦ Dam construction, reservoir capacity design, spillway capacity, sizes of water supply pipe lines all are designed on the basis of hydrological equations.
- ⑧ Determining the water balance of a region.
- ⑨ Determining the agricultural water balance.
- ⑩ Flood forecasting and flood warnings.
- ⑪ Designing drainage system.
- ⑫ Designing bridges.
- ⑬ Designing irrigation schemes and managing agricultural productivity.

Engineering Hydrology :-

The study of hydrology concerned mainly with engineering applications is known as engineering hydrology.

OR

Branch of hydrology that deals with engineering applications such as planning, designing, operating and maintaining water resources projects.

Engineering Hydrology deals with:-

- ① Estimation of water resources.
- ② The study of processes such as runoff, precipitation and their interaction.
- ③ The study of problems such as floods, droughts and strategies to overcome them.

Hydrologic Cycle:-

The hydrologic cycle begins with the evaporation of water from the surface of the ocean. A moist air is lifted, it cools and water vapour condenses to form clouds.

* Moisture is transported around the globe until it returns to the surface as precipitation.

* Once the water reaches the ground one of two processes may occur:

① - Some of the water may evaporate back into the atmosphere.

② - The water may penetrate the surface and become groundwater.

Groundwater either seeps its way into oceans, rivers and streams or may saturate into ground through capillary action.

The water that remains on the earth's surface is runoff, which generally directly find their way into lakes, rivers and streams. And the process is continued.

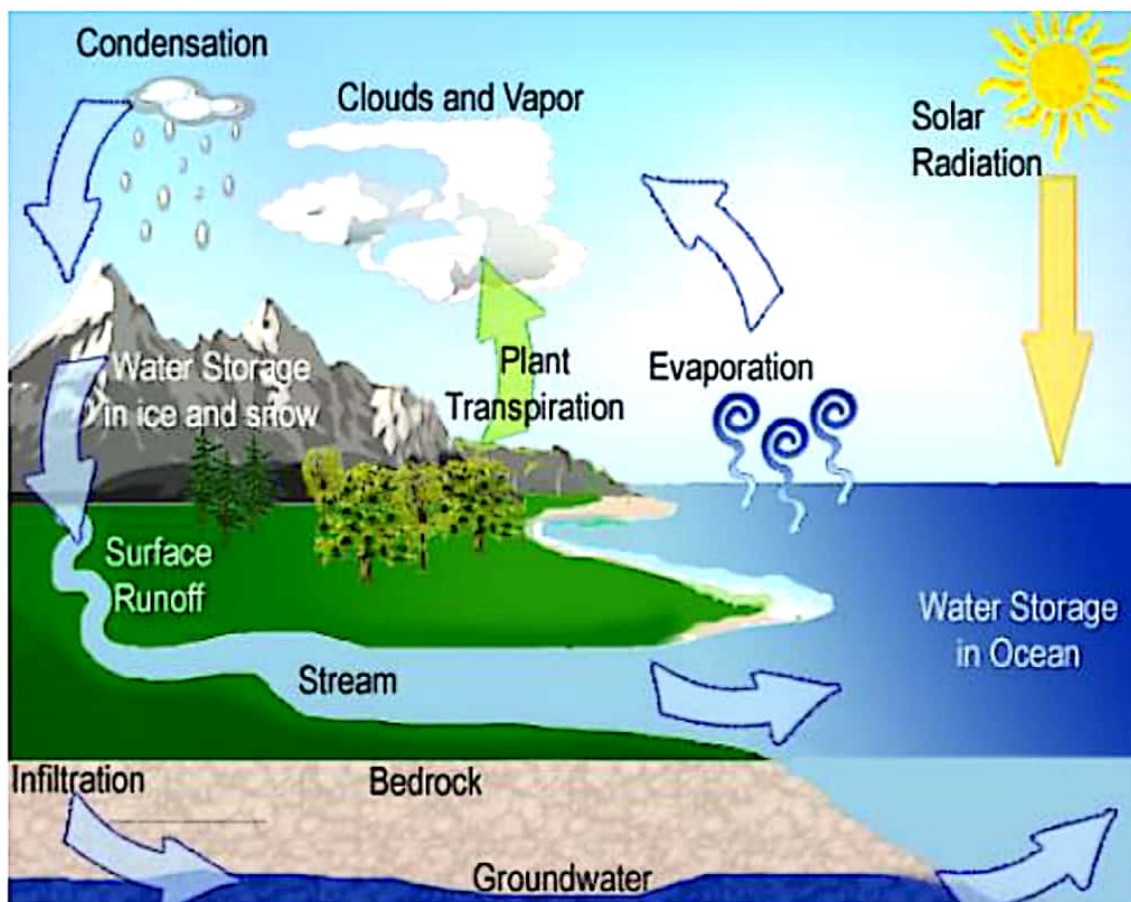
Processes:-

- 1- Precipitation → Condensed water vapor that falls to the earth's surface. Most of precipitation occurs as rain, snow and hail etc.
- 2- Run off → The variety of ways by which water moves across the land. This includes surface runoff and channel runoff. As it flows, the water may seep into the ground, evaporate into the air, become stored in lakes or reservoirs or be extracted for agricultural or other human uses.
- 3- Infiltration → The flow of water from the ground surface into the ground. Once water is infiltrated the water becomes soil moisture or ground water.
- 4- Sub surface flow → The flow of water underground. Sub surface water may return to the surface (eg. as a spring or by being pumped) or eventually seep into oceans.

5 — Evaporation → The transformation of water from liquid to gas states as it moves from ground into the atmosphere. The source of energy for evaporation is solar radiation.

6 — Transpiration → The release of water from plants and soil in the air.

The hydrological cycle is also known as water cycle. It is the continuous movement of water on above or below the surface of the earth.



Hydrologic Equation:-

The quantification of the hydrologic cycle which is an open system can be represented by a mass balance equation.

$$I - O = \Delta S = I - O \pm \text{change in storage}$$

where I is inflow into system during a defined period.

" O " is outflow from a system during a defined period and ΔS is change in storage in the system during the period.

This equation uses the principles of Conservation of mass in a closed system, where by any water entering a system (via precipitation) must be transferred into either evaporation, surface runoff or stored in the ground.

ΔS change in storage may be subdivided into several parts:

- Change of Moisture Storage in the Soil (ΔM)
- Change in Lakes and reservoirs (ΔL)

- change in river channels (ΔS_c)
- change in Glaciers (ΔS_g).

$$\text{So } \Delta S = \Delta M + \Delta L + \Delta S_c + \Delta S_g.$$