## WATER RESOURCES (CT309)

Water resources are natural resources of water that are potentially useful.

Uses of water include agricultural, industrial, household, recreational and environmental activities.
$97 \%$ of water on the Earth is salt water and only three percent is fresh water.
Two third of this percentage is frozen in glaciers and polar ice caps.

## Water is available to support life on Earth through the hydrological cycle.



Fig. 1.1: Global distribution of salt and fresh water


Fig. 1.2: Global distribution of fresh water

Freshwater must be exist from different sources to be used in different purposes

- Consumptive uses (in which the water is not necessarily returned to resource):
- River water abstraction and storage in reservoirs (for public, private and industrial water supplies);
- Abstraction from groundwater (for same water supply purposes);
- Irrigated agriculture;
- Watering of livestock;
- Non-consumptive uses:
- Recreational enjoyment (fishing, walking, sightseeing, bathing);
- Water abstract for cooling purposes(e.g. power stations and industrial refrigeration plant);
- Navigation in rivers and canals;
- Dilution and dispersion of suitably treated effluents from sewage treatment works, farms, etc.

1-Surface Water Resources
They are rivers, streams, lakes and reservoirs; which are very important for life.

The main uses of surface water include drinking, irrigation and industries.

Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, evapotranspiration and groundwater recharge.

## The area of Earth surface:

The total area of the surface of Earth is 510 billion $\mathrm{km}^{2}$. Over $71 \%$ of this area is occupied by The World Ocean and $29 \%$ is covered by land.

Water and land are distributed unevenly; in the Northern Hemisphere land extends over 39\% of its area while in the Southern Hemisphere $19 \%$.
The area of water in the Northern Hemisphere is $61 \%$ and in the Southern Hemisphere is $81 \%$.

## The World Ocean:

The World Ocean is divided into four separate oceans by the distribution of the land namely the Pacific, Atlantic, Indian and Arctic Oceans, and into numerous seas, gulfs, bays and straits.

## Lakes:

Lakes are widespread on all continents. Their total area is about $1.5 \%$ of the land area.

## Reservoirs:

They are used for public water supply, irrigation, hydropower generation and for other purposes.
The large reservoirs constructed during the twentieth century substantially transformed the volume and pattern of fresh water stored on the land surface. They also allowed the development and maintenance of inter-basin transfer system.

Reservoirs have been built by constructing a dam to raise the water level of an existing lake.

Other types of reservoirs are those ones filled in natural depression by diverting water from a river or by pumping.

## 2- Ground Water Resources

It is the part of precipitation that seeps down through the soil until reaches rock layer saturated with water.

Water underground is stored in the spaces between soil particles.

Groundwater slowly moves at a downward angle due to gravity and may seep into streams, lakes and oceans.
The volume of gravitational water contained in the pores, fissures and fractures of the water-saturated strata of the Earth's crust represents the natural storage of water underground.

The geological distribution of groundwater is related to the geological structure of the Earth's crust and also depends on the climatic factors: precipitation, condensation and evaporation and particularly on the infiltration.

Since runoff also depends on these factors, there is a strong relationship between groundwater and runoff: groundwater draining to rivers is included in the volume of runoff, being its most stable contribution to the hydrograph, especially during dry periods and drought.

