2.5 CLAY MINERALS

Types:

i. Montmorrilonite

ii. Kaolinite

iii. Illite

iv. Bentownite

As far as civil engineering projects are concerned Montmorrilonite clay is likely to pose more complicated problems than the other two types of clay

Engineering properties of clays:-

- Porosity

- Permeability

- Consistency of soils

  - Liquid limit

  - Plastic limit

  - Shrinkage limit

  - Plasticity index

- Activity of clays

- Shear strength

- Swelling

- Shrinkage

i. Porosity:-

Porosity of clay is defined the ratio of pore spaces present in the sample to the total volume of the sample

a = (v/V) x 100

a = porosity of clay, expressed in %

v = volume pores space present in the sample

V = the total volume of clay

ii. Permeability:-

The capacity of strata to transmit water through it is called permeability.

iii. Consistency of soils:-

Consistency denotes degree of firmness of the soil it is related to water content of the soil.

a. Liquid limit (Wl) :-

It is defined as the minimum water content at which the soil is still in the liquid state.

b. Plastic limit (Wp) :-

It is defined as the minimum water content at which a soil will just begin to crumble, when rolled into a thread of 3 mm diameter.

c. Shrinkage limit (W3) :-

It is defined as the minimum or lowest water content at which a soil can still be completely saturated.

d. Plasticity index (Ip) :-

It is defined as the numerical difference between the liquid limit and the plastic limit of a soil.

$$Ip = W2 - WP$$

Whenever the plastic limit is greater than the liquid limit, for practical purpose, the plasticity index is considered to be zero.

iv.   Activity of Clays (Ac) :-

The activity of clay (Ac) is defined as the ratio of plasticity index to the percentage weight of soil particles of diameter less than 2 microns, present in the clay sample.

$$Ac = \frac{Ip}{Cw}$$

Where, Ac = Activity of clay

Ip = plasticity of index

Cw = % weight of 0.002 mm sized grains present in the sample.

v)   **Shear Strength:**

The shear strength of soil is the resistance to deformation by continuous shear displacement of soil particles.

Engineering Importance:-

Behavior of clay:

1. Swelling property during rainy season

2. Shrinkage during hot summer

Swelling of clay leads to total uplifting of structure and its shrinkage leads to settlement of the structure built on it.

Suppose, the swelling and shrinkage are not uniformly distributed, it leads to unequal settlement of the structure and development of cracks on the structure.

Physical properties of clay minerals:-

Crystal system   : Triclinic and Monoclinic

Colour   : Colorless, Grey, Brown, etc

Streak   : White

Lusture   : Dull and Earthy

Hardness   2

Specific Gravity : 2.6

Form   : Massive Earthy

Composition   : Hydrous Aluminium silicate

Occurrence   : occurs as alteration products of alkali feldspars

Uses   : Used in the manufacture of Bricks, Tiles, and Ceramic.

                    Used in manufacture of household utensils and used as filters.