Q NO 1: (a) What is weathering and briefly write it types?

Ans: It is the integration of layers of rocks in to smaller pieces by some external or Internal agents. The rocks from which soil is formed is called weathering. weathering is the breaking down or dissolving of rocks and minerals on Earth Surface. once a rock has been broken down, a process called erosion transports the bits of rocks and minerals away. water, Ice, acids, salts, plants, animals and changes in temperature are all agents of weathering. Plants and animals life, atmosphere and water are the major agents of weathering.

TYPES OF WEATHERING: The types of weathering are depends upon the agents Involved in weathering. weathering are may of two types.

(1) MECHANICAL WEATHERING:

Mechanical weathering can be defined as, "It is fragmentation of parent rocks by physical forces, such as those resulting from temp stresses, from the formation of ice, wind, running water etc.

The breaking down of larger rocks in to smaller rocks. No chemical changes to rock.

Example. Freeze thaw action.

(2) CHEMICAL WEATHERING:

Chemical weeathering can be defined as, "In chemical weeathering, the parent rocks are converted in to new minerals by chemical. A chemical reaction occurs in the rock causing it to dessolve and forming new substances.

Example: Limestone dissolved by rainwater, forming Calcium Carbonate in Caves.

(3) Biological weathering :- It may be defined as, "The disintegration of rocks due to the actions of plants and animals are known as Biological disintegration.

(b) Define Porosity, Voids Ratio, water content, Specific gravity of Solids and degree of Saturation?

Ans: Porosity : It is the ratio of volume of voids in a given Sample to the total volume of Soil Sample. It may be expressed in Percentage or in a decimals.

$$n = \frac{V_v}{V} \times 100$$

The Answer/Value is in %

Percent.

Porosity or voids fraction is a measure of the voids spaces in a materials, and is a fraction of the volume of voids over the total volume between 0 and 1 or as percentage between 0% and 100%.

Voids Ratio: Voids ratio is the ratio between the volume of voids and volume of solids in a given soil sample.

It is denoted by small e.

$$e = \frac{\text{Volume of voids}}{\text{Volume of solids}}$$

$$e = \frac{V_v}{V_s}$$

Voids have typically diameter of 10 to 100 megaparsecs.

WATER CONTENT : It is defined as, "The ratio of the weight of water to weight of soil solids (dry weight of soil) in a given soil sample.

$$W_{Total} = \frac{W_w}{W_d}$$

$$W = W_s + W_w$$

$$W = V_s + V_a + V_2$$

$$w = \frac{W - W_a}{W_d}$$

Water content is the quantity of water contained in a meterials, such as soil, rocks, ceramics, crops, wood

Specific Gravity of solids: In soil mechanics, specific gravity generally refers to the specific gravity of soils solids and is defined as, "the ratio of the unit weight of soil solids to the unit weight of water of the same volume at 4°C

$$G = G_s = \frac{\gamma_s}{\gamma_w}$$

$$G = \frac{\gamma_s V_s}{\gamma_w V_w}$$

$$G_s = \frac{W_s}{W_w}.$$

Degree of Saturation: It is the ratio of volume of water present in the voids of a given soil sample to the total volume of soil.

$$S_r = \frac{V_w}{V_v}$$

It, is Usually expressed in percentage. It is also called percent Saturation.
It value ranges from 0 to 1 or 0 to 100 percent.

$S_r = 0$ for fully dry soil.

$S_r = 1$ for fully saturated soil.

$$S_r = \frac{V_w}{V_v} \rightarrow (A)$$

$$V_v = V_w + V_a$$

$$V_v = V_w$$

$$S = \frac{V_w}{V_v} \Rightarrow S_r = 1$$

Question No 3:

Write a note on consistency limits (Atterberge limits) in details?

Ans: The moisture / water content at which a fine grained soil changes from one state of consistency to another state of consistency are termed as consistency limits or Atterberge limits. There are three Atterberge limits.

(i) Liquid limit (LL or W_L):

It is a moisture content at which soil changes from plastic to liquid state and vice versa.

OR

It is a moisture content beyound which soil acts like a liquid for labortary determination.

It is a moisture content at which a part of soil of standard dimension will flow

together for a distance of half inch under impact of 25 blows.

(2) Plastic limit (P.L / w_p): It is a moisture content at which soil changes from its plastic state to Semi solid state and vice versa. For Laboratory determination plastic limit is a moisture content at which a soil will be just begin to crumble, when Rolled into a thread of approx $\frac{1}{8}$th Inch in diameter.

(3) Shrinkage limit (SL, w_s): It is a moisture content at which soil changes from its Semi solid state to solid state and vice versa. It is a moisture content at which soil attains constant volume i.e no reduction in volume on further drying.

Plasticity: It is defined as, "The property of soil due to which it can be rapidly deformed without rupture and without elastic rebound.

Plasticity Index: The difference between liquid limits and plastic limits is called plasticity index.

$$P.I = L.L - P.L \quad [\text{Expressed as +ve value}).$$

Plasticity Index gives the range with in which soil shows plastic properties - On the basis of plastic index various codes / oblique organization has divided soil into non-plastic, slightly plastic, low plastic, medium plastic, high plastic and very high plastic.

Q#02: An undistributed soil sample has a volume of 1100 cm^3 and mass of 210 gm and after drying mass of soil reduced to 160 gm. The specific gravity of soil is 3.0. Find:

① water content ② Dry Density ③ Moist Density.

SOLUTION:-

Given:

Volume of soil sample = V = 1100 cm^3

Mass of sample = 210 gm

Dry mass of sample = 160 gm

specific Gravity = 3.0.

Required: ① $w = ?$

② $\gamma = ?$

③ $\gamma_d = ?$

Sol:

Wet mass of Sample = 210 gm = 0.21 kg

Dry mass of Sample = 160 gm = 0.16 kg

Volume = 1100 cm^3 = 1100×10^{-6} m^3.

G.S = 3.0

(i) $w = \frac{w_w}{w_d}$

Mass of water = m_w = $m - m_d$

= 210 gm − 160 gm = 50 gm

0.05 kg

$W_w = m_w g = 0.05 \times 9.81 = 0.4905$ N

$W_d = 0.16 \times 9.81 = 1.56$ N

Putting values

$w = \frac{0.49}{1.56} \times 100$

$w = 31.41\ \%$.

(ii)

$$\gamma = \frac{w}{V}$$

$$\gamma = \frac{0.21 \times 9.81}{1100 \times 10^{-6}}$$

$$\gamma = 1870.5 \text{ N/m}^2$$

$$\boxed{\gamma = 18.6 \text{ KN/m}^2}$$ Ans

(iii) $$\gamma_d = \frac{w_d}{\gamma}$$

$$\gamma_d = \frac{0.16 \times 9.81}{1100 \times 10^{-6}}$$

$$\boxed{\gamma_d = 1425.4 \text{ N/m}^2}$$

$$\gamma_d = \boxed{14 \text{ KN/m}^2}$$ Ans

(b) Find relation between e, w, G_s, S_r for partially saturated soil ($e = wG_s/S_r$).

Proof: By definition:

$$w = \frac{W_w}{W_d}$$

$w = \gamma_v$ — (i)

$\gamma = \frac{w}{V}$ — (ii)

$w = \gamma V$ — (iii)

$$w = \frac{W_w}{W_s} \rightarrow \frac{\gamma_w V_w}{\gamma_s V_s}$$

$$w = \frac{V_w}{\left(\frac{\gamma_s}{\gamma_w}\right) V_s} \quad \text{— (A)}$$

And: $$S_r = \frac{V_w}{V_v}$$

$$V_w = S_r \times V_v$$

$$w = \frac{S_r \cdot V_v}{G_s \cdot V_s}$$

$$w = \frac{S_r \cdot}{G_s} e$$

$$w = \frac{S_r}{G_s}\left(\frac{V_v}{V_s}\right)$$

$$w = \frac{S_r}{G_s}\, e$$

$$e = \frac{wG_s}{S_r}$$

If soil is saturated

$$S_r = 1$$

$$e = \frac{wG_s}{S_r}$$

Hence proved