Anantha Lakshmi

Institute of Technology & Sciences

Approved by AICTE & Affiliated to JNTUA, Ananthapuramu,
An ISO (9001-2008) Certified Institute, Near S.K.U, Itikalapalli, Ananthapuramu Dist. A

DEPARTMENT OF CIVIL ENGINEERING

UNIT-I

INTRODUCTION

1. **What is meant by degree of saturation?**

   The degree of saturation is defined as the *ratio of volume of water (V_w) to the volume of voids (V_v)*.

   $$S = \frac{V_w}{V_v} \times 100$$

2. **List various factors affecting the compaction.**

   Following the different factors affecting compaction of soil:

   (i)   Water content (ii) Amount of compaction (iii) Types of soil (iv) Methods of soil compaction

3. **What do you mean by water content in a soil sample?**

   By definition the water content (w) is the ratio of the weight (or mass) of the water and the solids, $w = W_w / W_s$.
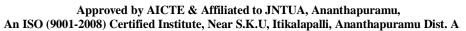
4. **Define Porosity of a given soil sample.**

   Porosity of the soil (n) is defined as the ratio of volume of voids (V_v) to the total volume of soil sample (V). It is expressed as **n= V_v/V x 100%**

5. **Define Void Ratio.**

   Voids ratio of the soil (e) is defined as the ratio of volume of voids (V_v) to the volume of solids (V_s). Then it is expressed as, **e = V_v / V_s x 100 %**

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UNIT II

PERMEABILITY AND SEEPAGE THROUGH SOILS

1. **List out the forms of Soil water.**

   Soil water may be in the forms of (i) Free water or Gravitational water and (ii) Held water.

   (i) *Gravitational water* - (*a*) free water (bulk water) and (*b*) Capillary water.

   Free water may be further distinguished as (*i*) Free surface water and (*ii*) Ground water.

   (ii) *Held water* is that water which is held in soil pores or void spaces because of certain forces of attraction. It can be further classified as

   (a) Structural water and (*b*) Absorbed water- Hygroscopic water and Film Moisture

2. **State the name of the methods of finding field permeability.**

   The following are the methods used in the field to determine permeability.

   1. Pumping out of wells and   2. Pumping into wells

3. **What is capillary rise, capillary moisture and capillarity?**

   The phenomenon in which water rises above the ground water table against the pull of gravity, but is in contact with the water table as its source, is referred to as ‗Capillary rise'
   The water associated with capillary rise is called ‗capillary moisture'. The phenomenon by virtue of which a liquid rises in capillary tubes is, in general, called ‗capillarity'.

4. **Define Darcy's Law.**

   Darcy's law states that for laminar flow conditions in a saturated soil, the rate of flow or the discharge per unit time is proportional to the hydraulic gradient.
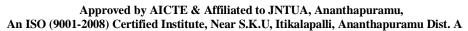
   $$q = K_iA, \qquad V = q/A = k_i$$

   Where,

   q = discharge per unit time, A = Total cross-sectional area of soil mass perpendicular to the Direction of flow, i = hydraulic gradient, k = Darcy's Coefficient of permeability

   v = Velocity of flow, or average discharge velocity.

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UNIT –III
STRESS DISTRIBUTION IN SOILS

1. **What are the assumptions of Boussinesq Equations?**
   o The soil mass in homogeneous, that is all its constituent parts or elements are similar and it has identical properties at every point in it in identical directions.
   o The soil mass is isotropic, that is it has identical elastic properties in all directions through any point of it.
   o The soil mass is semi-infinite, that is it extends infinitely in all directions below a level surface.

2. **Define isobar.**
   An isobar is a curved or contour connecting all points below the ground surface of equal vertical pressure.

3. **Define pressure bulb or Stress isobar.**
   The zone in a loaded soil mass bounded by an isobar of given vertical pressure intensity is called a pressure bulb.

4. **Write down the Boussinesq equations of vertical pressure due to concentrated load.**

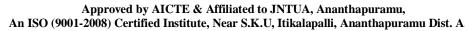$$\sigma_z = \frac{3Q}{2\pi z^2} \left[\frac{1}{1 + \left(\frac{r}{z}\right)^2} \right]^{5/2}$$

Q = point load

z = depth of stress acting

r = distance from the axis of load

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UNIT- IV

CONSOLIDATION

1. What is consolidation?

The phenomenon in which water rises above the ground water table against the pull of gravity, but is in contact with the water table as its source, is referred to as consolidation. The water associated with capillary rise is called consolidation. The phenomenon by virtue of which a liquid rises in capillary tubes is, in general, called consolidation.
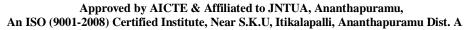
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    b. *Held water* is that water which is held in soil pores or void spaces because of certain forces of attraction. It can be further classified as

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UNIT-V
SHEAR STRENGTH

1. **What is shear strength?**
   Shear strength may be defined as the resistance to shearing stresses and a consequent tendency for shear deformation. It is the most important of its engineering properties. Shearing strength of a soil is the most difficult to comprehend in view of the multitude of factors known to affect it.

2. **What are the factors that influence shear strength?**
   (1) Resistance due to the interlocking of particles.

   (2) Frictional resistance between the individual soil grains, which may be sliding friction, rolling friction, or both.

   (3) Adhesion between soil particles or ‗cohesion'.

3. **What is principle plane and principle stress?**
   A ‗Principal plane' is defined as a plane on which the stress is wholly normal, or one which does not carry shearing stress. There are three principal planes at any point in a stressed material. The normal stresses acting on these principal planes are known as the ‗principal stresses.

4. **What are shear strength parameters?**
   The parameters are (i) Void ratio, e_f at failure, (ii) Effective normal stress on the failure plane, at failure, (iii) Cohesion, (iv) Angle of internal friction

5. **Mention any four laboratory methods to measure the shear strength of soil.**
   1. Direct Shear Test

   2. Tri-axial Compression Test

   3. Unconfined Compression Test

   4. Laboratory Vane Shear Test