V V COLLEGE OF ENGINEERING

Civil Engineering

Sub.Code/Name: CE 8491 – SOIL MECHANICS **Sem : IV**

Two Marks

UNIT 1

1. Define liqiud limit (Nov Dec 2017)

The liquid limit is defined as the water content at which the behavior of a clayey soil changes from plastic to liquid. However, the transition from plastic to liquid behavior is gradual over a range of water contents, and the shear strength of the soil is not actually zero at the liquid limit

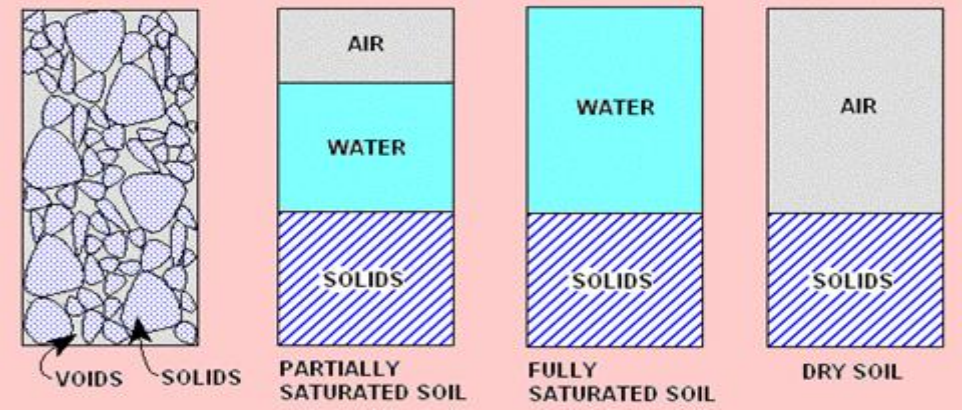
2. Define Plastic limit

Plastic limit is defined as the maximum water content at which, soil changes from plastic to semi-solid state.

3. Define Shrinkage limit

The shrinkage limit is defined as the water content where further loss of moisture will not result in any more volume reduction

4.Draw phase diagram for Partially saturated soil (3 phase diagram), Fully saturated soil (2 phase) & dry soil (2 phase) (Nov Dec 2016) (April May 2017)



5. What are the Factors influencing compaction (Nov Dec 2017) (April May 2017)

- Water content
- Type of soil:
- Amount of compaction
- Method of compaction
- Addition of Admixtures

6.What are the Field compaction Methods & field compaction Equipments (Nov Dec 2016) (April May 2015)

Field compaction Methods

- Tampers
- Rollers
- Vibrators

Field Compaction Equipments

- A hand – operated tamper (rammer)
- Smooth – Wheel Rollers
- Pneumatic tyred rollers
- Sheep – foot rollers
- Vibratory compactors

7. **What are the Laboratory compaction Methods**

- Standard proctor compaction test
- Modified proctor compaction test
- Jodhpur mini compactor test
- Abbott compaction test
- Harvard Miniature Compaction test

8.Define Air content and percentage air voids in soil

The air content is defined as the ratio of volume of air void to the volume of voids

$$a_c = \frac{V_a}{V_V}$$

Percentage of air voids is defined as the ratio of the volume of air voids to the total volume of soil mass.

$$n_a = \frac{V_a}{V} \times 100$$

9.Distinguish between Residual and Transported soil (May/June 2012)

Residual soils are found at the same location where they have been formed. Generally, the depth of residual soils varies from 5 to 20 m. Residual soils comprise of a wide range of particle sizes, shapes and composition

Weathered rock materials can be moved from their original site to new locations by one or more of the transportation agencies to form transported soils. Transported soils are classified based on the mode of transportation and the final deposition environment.

10. Derive the relationship between voids ratio and porosity

$n = \frac{V_v}{V}$ refer fig 2, now $n = \frac{e}{1+e}$

for dry soil mass & saturated soil mass $n = \frac{e}{1+e}$

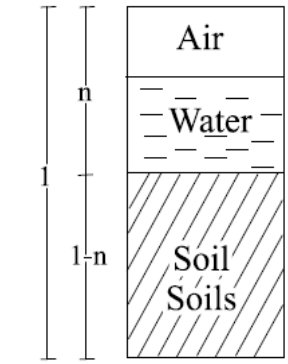
Taking reciprocals on both sides we get $\frac{1}{n} = \frac{1+e}{e} = \frac{1}{e} + 1$

we get $\frac{1}{e} = \frac{1}{n} - 1 = \frac{1-n}{n}$ => $e = \frac{n}{1-n}$

alternatively

we have $n = \frac{V_v}{V}$ if V = 1 then Vv = n, Vs = 1- n

therefore $e = \frac{Vv}{Vs} = \frac{n}{1-n}$ => $e = \frac{n}{1-n}$



Soil Element interms of 'n'

FIG - 3

11. Define degree of saturation. (Nov Dec 2011)

The degree of saturation is defined as the ratio of volume of water to the volume of voids

S =Vw/Vv

For fully saturated soil S=100%,

For perfectly dry soil S=0

12. Define Void Ratio **(AUC Nov/Dec 2010)**

The void ratio of a soil is defined as the ratio of volume of voids to the volume of solids.

e = Vv/Vs

13. Define specific gravity.

It is defined as the ratio of the mass of a given volumes of solid gains to the mass of equal volume of water at the same temperature

$$G = \frac{\gamma s}{\gamma w} \text{ (or) } \frac{\rho s}{\rho w}$$

14.**What is compaction?**

Compaction is a process by which the soil particles are artificially rearranged and packed together into a closer strata of contact by mechanical means in order to decrease the porosity (or voids ratio) of the soil and thus increase its dry density.

15. Aim of the compaction

- To increase the shear strength soil
- To improve stability and bearing capacity
- To reduce the compressibility
- To reduce the permeability of the soil.

16. What are the methods available for sieve analysis? (April May 2011)

- Dry sieve Analysis
- Wet sieve analysis

17. Atterberg limits: define (Nov Dec 2010) (April May 2011) (Nov/Dec 2012)

The limit at which the soil, changes from one state to another state, is termed as atterberg limits.

- Liquid limit
- plastic limit
- shrinkage limit

18.Give the relationship between γ_{sat} γ_w ,G, e (April May 2012)

$$\gamma_{sat} = \frac{(G+ e)}{1+e} \quad \gamma_w$$

19. What is water content in given mass of soil? (Apr / May 2011)

It is defined as the ratio of water (Ww) present in a soil mass to the weight of soil solids (Ws) it is usually as %. It is also referred to as moisture content.

$$w = \frac{Ww}{Ws} \text{ x } 100 \quad \%$$

Range – 0 to ∞ for sand – 10 % to 30 % for clay – 5 % to 300 %.

20. Define Porosity (Nov/Dec 2010)

It is defined as the ratio of volume of voids to the total volume (V) of soil mass Expensed as %. It is also referred to as percentage voids. $0 < n < 100\%$

$$n = \frac{V_v}{V} \text{ x } 100 \quad \%$$

21. If the liquid index of a soil is zero .Find its consistency index (MAY / JUN2013)

$$I_L = \frac{W - Wp}{Ip} = 0 \text{ (given)}$$

Therefore , W- Wp = 0 ⟶ W = Wp

We know that , $Ic = \frac{W_L - W}{Ip}$

$$I_C = \frac{W_L - W_P}{Ip} = 1 \qquad \text{(Because } W_L - W_P = Ip \text{)}$$

UNIT 2

1.What is quick sand condition? Under what circumstance can it occur?(April May 2017)

Quicksand forms in saturated loose sand when the sand is suddenly agitated. When water in the sand cannot escape, it creates a liquefied soil that loses strength (shear strength equals to zero) and cannot support weight. Quicksand can form in standing water or in upwards flowing water. In the case of upwards flowing water, seepage force oppose the force of gravity and suspend the soil particles.

2.Write range of co-efficient of permeability for gravel ,sand ,silt &clay. (April May 17)

Soil	k (cm/sec)
Gravel	10^0
Coarse sand	10^0 to 10^{-1}
Medium sand	10^{-1} to 10^{-2}
Fine sand	10^{-2} to 10^{-3}
Silty sand	10^{-3} to 10^{-4}
Silt	1×10^{-5}
Clay	10^{-7} to 10^{-9}

3. Differentiate discharge velocity and seepage velocity(Nov Dec 2016) (Nov Dec 2015)

- Discharge velocity is the rate of flow of a liquid across a given cross sectional area, though not necessarily into the ground.
- The actual velocity (or) seepage velocity is defined as the rate of discharge of percolating water per unit cross-sectional area of voids perpendicular to the direction of flow.
- Seepage velocity is always greater than Discharge velocity.

Seepage velocity(V_n) = Discharge velocity(V)/Porosity(n)

4.State Darcy's law of permeability of soil (Nov Dec 2016)

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.

$$q = KiA$$
$$v = q/A = k.i$$

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.

5.Define critical hydraulic gradient(Nov Dec 2016)

Critical hydraulic gradient (i_c) is defined as the upward hydraulic gradient where the quick sand condition occur. It is the hydraulic gradient at which effective stress become zero.

6.List various types of soil water(Nov Dec 2016)

1.Free water (or) Gravitational water
2.Held water
a. Structural water b. Absorbed water c. Capillary water

7.Define liquefaction

Liquefaction is a phenomenon in which the strength and stiffness of a soil is reduced by rapid loading (vibration, earthquake shaking). Liquefaction occurs in saturated soils, that is, soils in which the space between individual particles is completely filled with water. At this stage shear strength of soil is equals to zero and the soil particle behaves like liquid.

8.List the various uses of flow net in engineering practices

- Determination of seepage
- Determination of hydrostatic pressure
- Determination of seepage pressure
- Determination of exit gradient

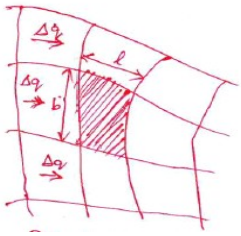
9. Define exit gradient

The exit gradient is the hydraulic gradient of the downstream end of the flow line where the percolating water leaves the soil mass and emerges into free water at the downstream.

$$ie = \frac{\Delta h}{l.}$$

10. Define flow net(April May2015, 2011, 2009) (Nov Dec 2017)

Graphical Construction used to calculate groundwater flow through soil. It Comprised of Flow Lines and Equipotential Lines which are perpendicular to each other.



11.Write the properties of flow net (April May2015)

1) The flow line and equipotential line meet at right angles to one another.

2) The fields are approximately squares, so that a circle can be drawn touching all the four sides of the square.

3) The quantity of water flowing through each flow channel is the same. Similarly, the same potential drop occur between two successive equipotential lines.

4) Smaller the dimensions of the field, greater will be the hydraulic gradient and velocity of flow through it.

5) In a homogeneous soil, every transition in the shape of the curves is smooth, being either elliptical (or) parabolic in shape.

12. How do you know that the flow through soil obeys Darcy's law/Assumptions of Darcy law (April May 2015)

- The soil is saturated.
- The flow through soil is laminar.
- The flow is continuous and steady.
- The total cross sectional area of soil mass is considered.

13.Write the various types of field permeability test (Nov Dec 2017)

- Pumping – out test
- Pumping - in test

14.Write the various types of laboratory permeability test

- Constant head permeability test
- Falling head permeability test

15. **List the assumptions made in the Laplace's equation**
- The flow is laminar.
- Water & soil are incompressible.
- Soil is isotropic & homogeneous.
- The soil is fully saturated.
- The flow is steady ie. flow condition do not change with time.
- Darcy's law is valid.

16.Define Permeability. (June 2009)
Permeability is defined as the property of a porous material which permits the passage of water (or) other fluids through its interconnecting voids.

17. Define soil water(April May 2011)

Water that is present in pore spaces of the soil is called soil water

18. List out the methods of drawing flownet (May June 2010, 2012)
- Graphical method
- Electrical analogy method
- Soil models
- Plastic models

19.State the difference between Unconfined and confined aquifer (May June 2010)
An confined aquifer is an aquifer which is confined between two impervious beds
An unconfined aquifer is one in which a free water surface that is a water table exists at the top and impervious strata at the bottom.

20.List the factors affecting coefficient of permeability (Nov Dec 2008)
a) Grain size (particle size) b) Properties of the pore fluid
c) Voids ratio of the soil d) Structural arrangement of the soil particle
e) Entrapped air and foreign-matter. f) Adsorbed water in clayey soils.
g) Effect of Degree of saturation

21.Define laminar and turbulent flow(Nov Dec 2010)
Laminar flow:
Each fluid particle travels along a definite path which never crosses the path of any other particle.
Turbulent flow:
The paths are irregular, twisting, crossing and re-crossing at random.

22.What is meant by total,neutral &effective stress of soil (Nov Dec11,12 Ap May10,11)
- Neutral stress- due to pore water
- Total stress- due to the self-weight and external applied forces
- Effective stress- due to solid particles .It is the difference between total and neutral stress

23. What are the importance's for the study of seepage of water?

1. Determination of rate of settlement of a saturated compressible soil layer.
2. Calculation of seepage through the body of earth dams, and stability of slopes.
3. Calculation of uplift pressure under hydraulic structure and there safety against piping.
4. Ground water flow towards well and drainage of soil

24. Factors affecting soil suction

1) Particle size of soil	2) Water content	3) Plasticity Index of soil
4) History of drying and wetting	5) Soil structure	6) Temperature
7) Denseness of soil	8) Angle of contact	9) Dissolved salts in pore water

25.

Calculate the height to which water will rise (Capillary rise) in a soil deposit Consisting of fine silt of uniform in size. The depth of water below the ground surface is 20 m Assume the surface tension is 75×10^{-8} kN/cm & contact angle is zero. The average size of pores is 0.004 mm

Given:

depth of water = 20m, $\alpha = 0$ (contact angle)

T_s, Surface tension $= 75 \times 10^{-8}$ kN/cm

$= 75 \times 10^{-8} \times \frac{10^3}{10^2}$ N/m

$T_s = 75 \times 10^{-7}$ N/m

$d = 0.004 \text{ mm} = 4m$

Soln:

$$h_c = \frac{4 T_s \cos\alpha}{d \gamma_w}$$

$$= \frac{4 \times 75 \times 10^{-7}}{4 \times 9.81}$$

$$h_c = 7.645 \times 10^{-7} \text{ m}$$

UNIT 3

1.What is the principle behind Newmarks influence chart (April May 2017)

- New mark given a graphical procedure for computing the vertical stress of soil medium, having any type of loading. This chart is applicable for homogeneous, soil mass.
- A chart consisting of number of circles and radiating lines. The influence of each circle is the same. That is each area unit causes the equal vertical stress.

$\sigma_z = Inq$

I – influence value = 0.005

n – number of area units under the loaded area.

2.Define coefficient of consolidation and compression index (April May 2017)

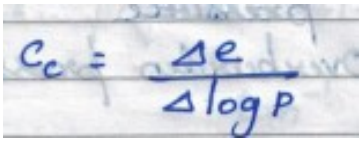
Coefficient of consolidation(c_v): It is defined as the combined effects of permeability & volume of compressibility of soil on the rate of volume change

$$c_v = k/\gamma_w m_v$$

Compression index (Cc):

- It is defined as the slope of the linear portion of the voids ratio verses log p
- It is an important parameter for evaluation of settlement due to primary consolidation settlement of clays .

$C_C = 0.009(W_L - 10)$



3.What is the basic of the construction of newmarks influence chart? (Nov Dec 2015)

To use the chart for determining the vertical stress any point under the loaded area the plan of the loaded area is first drawn on a tracing paper.

1. The plan of the loaded area is then so placed over the chart that the point below which pressure is required coincides with the centre of the chart.
2. The point below which pressure is required may lie within or outside the loaded area.
3. Total number of area units covered by the plan of the loaded area is counted.
4. Vertical pressure is then caculated from

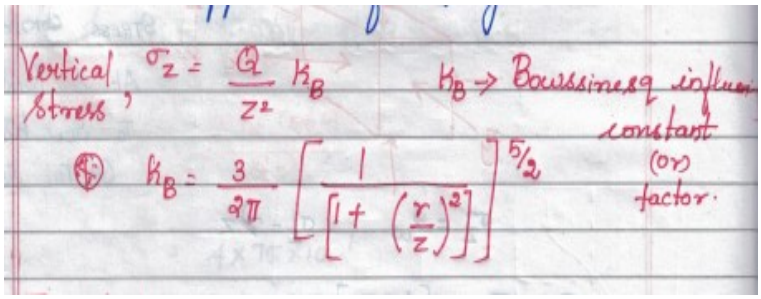
$\sigma_A = 0.005\, q\, N_A$

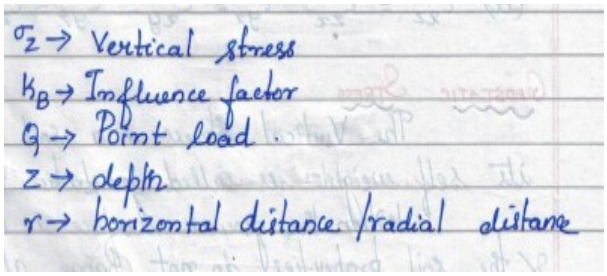
N_A – No of area units under under a loaded area.

4.What are the factors that influence the compression behaviour of soil? (Nov Dec 2015)

- Shape And Size Sample
- Type Of Soil
- Rate Of Application Of Load
- Moisture Content

5. State the boussinesq formula for vertical stress distribution in soil under a point load(Nov Dec 2016)





6.State drainage path length for single & double drainage conditions for a soil layer(height H) (Nov Dec 2016)

Drainage path length for single drainage condition **,d = H**

Drainage path length for Double drainage condition,**d= H/2**

7.What is the use of consolidation test data? (Nov Dec 2017)

- Amount of settlement experienced by a soil-structure after load application
- Rate of consolidation of soil under a normal load
- Degree of consolidation at any time
- Pressure void ratio relationship
- Coefficient of consolidation at various successively increasing pressure
- Permeability of soil at various stages of loading
- Compression index of soil

8.Find the compression index of remoulded sample with liquid limit of 40% (Nov Dec 2017)

Compression index ,C_C $= 0.009(W_L\text{-}10)$

$= 0.009(40\text{-}10) = 0.27$

9.Define over consolidated and normally consolidated soils (April May2015)

If the current effective stress(σ') is equal (note that it cannot be greater than) to the preconsolidation stress, then the deposit is said to be normally consolidated(NC).

If the current effective stress is less than the preconsolidation stress, then the soil is said to beover-consolidated (OC).

10. What are the Stages of consolidation.(MayJune2016)

The stages of consolidation are

· Initial consolidation

· Primary consolidation

· Secondary consolidation

11.Compare Boussinesq's and westergaard analysis of stress distribution(April May2015)

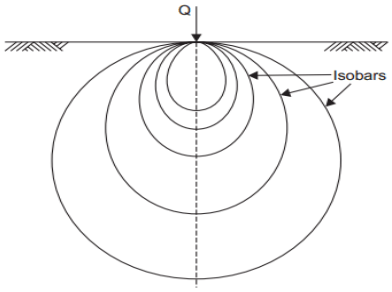
BOUSSINESQ'S THEORY	WESTERGAARD ANALYSIS
Assumes that soil is isotropic	Assumes that soil is Non isotropic
Soil mass would behave in all direction in a similar fashion	Soil mass would not behave in all direction in a similar fashion

12.What Is Iso-Bar?

An Isobar is a curve or counter connecting all points below the ground surface of equal vertical pressure on a given horizontal plane is the some in all directions at points located at equal radial distances around the axis of loading

13.Define Stress isobar/ pressure bulb.(MayJune2016) .(May June 2009)

A stress isobar or pressure bulb is a stress contour or a line which connects all points below the ground surface at which the vertical pressure is the same. In fact, an isobar is a spatial curved surface and resembles a bulb in shape; this is because the vertical pressure at all points in a horizontal plane at equal radial distances from the load is the same. Thus, the stress isobar is also called the 'pressure bulb'.



14. What are the reasons for compression of the soil?

- Compression of solid particles & water in the voids.
- Compression & expulsion of air in the voids.
- Expulsion of water in the voids.

15.What are the components of settlement

- Initial settlement
- Primary consolidation settlement
- Secondary consolidation settlement

16.Define consolidation?

Consolidation is an process which involves a decrease in water content of saturated soil without replacement of water by air.

17.What is Immediate settlement

The settlement which is caused by the elastic deformation of dry soil and of moist and saturated soils without any change in moisture content.

18. What is primary consolidation settlement?

The settlement which results of volume change in the saturated cohesive soils because of expulsion of the water that occupies the voids space.

19. Define is secondary consolidation?(May June 2013)

The reduction in volume of soil continues at a very slow rate even after the hydrostatic pressure developed by the applied pressure is fully dissipated and which is the compression of soil that takes place after primary consolidation. The additional reduction in volume is called secondary consolidation.

20.Differentiate between consolidation and compaction.(May June 2012)

COMPACTION	CONSOLIDATION
Involves expulsion of air	Involves expulsion of water
Soil involved is partially saturated	Soil involved is fully saturated
Dynamic load is applied	Static load is applied
Relatively quick process	It is a slow process

21. What are the assumption are made in the Boussinque equations.(May June 2009)

- The soil mass is homogenous, that is all its constituent parts (or) elements are similar and it has identical properties at every point in it in identical directions.
- Te soil mass is an elastic medium for which the modulus of elasticity E is constant.
- The soil mass is "Isotropic" that is it has identical elastic properties in all directions through any point of it.
- The soil mass is semi-infinite that is, it extends infinitely in all directions below a level surface.

22.Define Contact Pressure?

Contact pressure defined as the vertical pressure acting at the the surface of contact between the base of footing and the underlying soil mass.

23.. What Is Compressibility?

When the compressive load is applied to soil mass, a decrease in its volume takes places.
The decrease in the volume of soil mass under stress is known as compression and the property of soil mass compressibility.

24.What are the assumption are made in the Terzaghi's theory of one-dimensional consolidation.(May June 2010)

1 .Soil homogenous and fully saturated
2 .Soil particles and water are incompressible.
3 .Deformation of the soil is due entirely to change in volume
4 .Darcy's law for the velocity of flow of water thorough soil is perfectly valid.
5 .Coefficient of permeability is constant during consolidation
6 .Load is applied deformation occurs only in direction
7 .The change in thickness of the layer during consolidation is insignificant.

25.Name the vertical stress distribution diagrams drawn using Boussinesq equation?

1. Vertical stress isobar diagram
2. Vertical pressure distribution on a horizontal plane.
3. Vertical pressure distribution on a vertical line.

UNIT 4
SHEAR STRENGTH

1.Write the Mohr-coulomb failure criterion for soils and explain the terms involved (April May 2017)

- Material fails essentially by shear
- the ulatimate shear stress depends on the normal stress on the potential failure plane& properties of material.
- In three dimensional stress system the failure criterion is independent of intermediate principle stress

2. List the merits of triaxial test (April May 2017)

Merits:

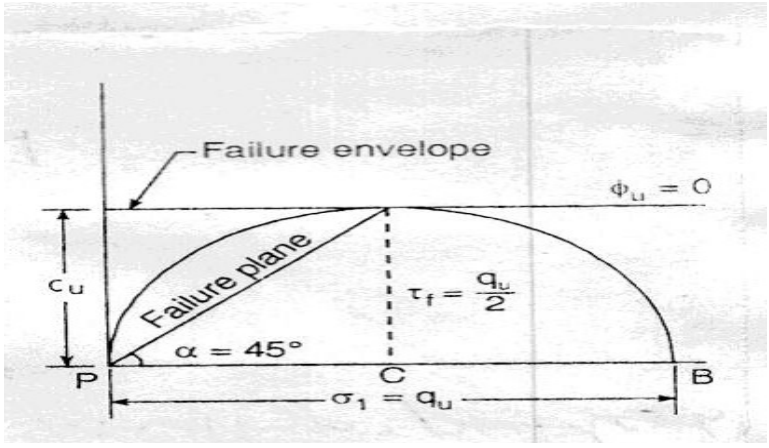
- There is a complete control over the drainage conditions.
- Pore pressure changes & the volumetric changes can be measured directly
- The stress distribution on the failure plane is uniform
- The specimen is free to fail on the weakest plane
- The Mohr Circle can be drawn at any stages of shear
- The test is suitable for accurate research work.

3.List the demerits of triaxial test (April May 2017)

Demerits:

- The apparatus is elaborate, costly and bulky
- The drainage test takes a longer period as compared with that in direct shear test.
- The strain conditions in the specimen are not uniform
- It is not possible to determine the cross sectional area of the specimen accurately at large strains
- The consolidation of the specimen in the test is isotropic whereas in the field ,the consolidation is generally anisotropic

4.Draw the Mohr's circle diagram for UCC test and mention the salient features (Nov Dec 2016)



5.Define liquefaction and the effects on structural stability due to liquefaction (Nov Dec 2016) (Nov Dec 2015)

Liquefaction is a phenomenon which occur in loose saturated fine cohesionless soils. If a saturated fine sand deposit is subjected to sudden vibrations (blasting,earthquake,heavy machinery), Rapid decrease in volume takes place and pore pressure increases to such extent that effective stresses become zero leading to complete loss of shear strength. At this stage behaves like liquid.

6.Define cyclic mobility

The term 'cyclic mobility' refers to the mechanism of progressive reduction of effective stress due to cyclic loading. This may occur in all soil types including dense soils. However, on reaching a state of zero effective stress such soils immediate dilate and regain strength. Thus, shear strains are significantly less than a true state of soil liquefaction whereby a loose soil exhibits flow type phenomena.

7.Draw the strength envelopes for fully saturated clay subjected to CD test.(April May2015)

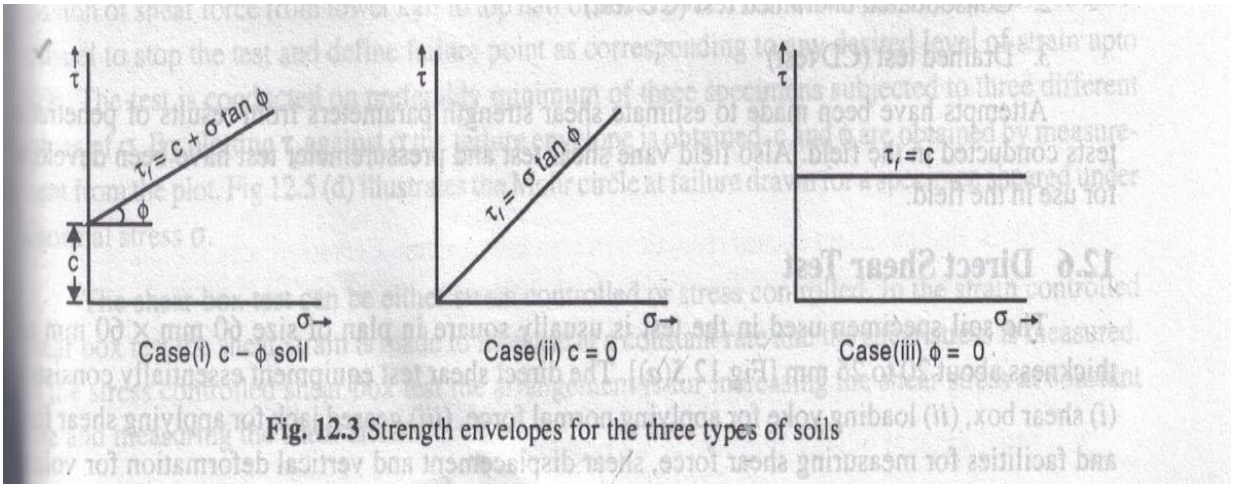
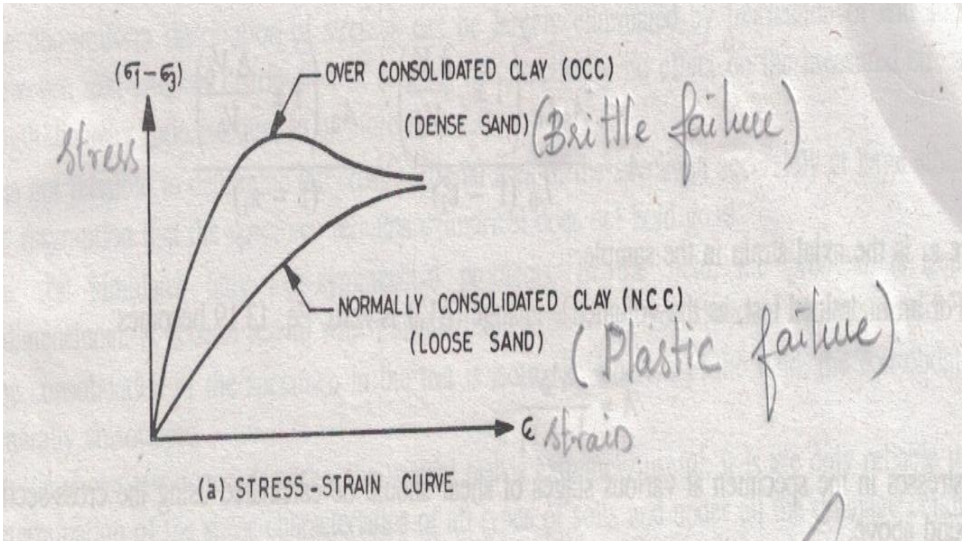


Fig. 12.3 Strength envelopes for the three types of soils

8.Draw typical stress-strain curve for specimens failed by brittle failure and plastic failure . (April May2015)



9.What are the advantages of direct shear test .(May June 2013)(April May2015) (Nov Dec 2017) (MayJune2016)

- The sample preparation is easy. The test is simple & convenient
- Thickness of the sample is small ,hence drainage is quick and pore water pressure dissipates rapidly
- It is ideal for conducting drained tests on cohesionless soils
- The apparatus is relatively cheap

10.What are the disadvantages of direct shear test .(April May2015) (MayJune2016)

- The stress conditions are known only at failure
- The stress distribution on the failure plane is not uniform
- The area under shear gradually decreases as the test progresses.
- The orientation of the failure plane is fixed. The plane may not be the weakest plane
- Control on the drainage conditions is very difficult.
- The side walls of the shear box cause lateral restraint on the specimen &do not allow it to deform laterally
- The measurement of pore water pressure is not possible

11. Define Deviator stress and its significance in triaxial shear strength test(Nov Dec 2016)

Deviator stress is the difference between the major and minor principal stresses in a triaxial test which is equal to the axial load applied to the specimen divided by the cross-sectional area of the specimen $\sigma_d = \sigma_1 - \sigma_3$

The deviator stress 'σ_d' at any stage of the test is given by

$$\sigma_d = F / A_c$$

σ_d = Deviator stress

F= Deviator force ie., additional axial force

A_c= cross sectional area of the specimen

Significance of Triaxial Testing

The first stage simulates in the laboratory the in-situ condition that soil at different depths is subjected to different effective stresses. Consolidation will occur if the pore water pressure which develops upon application of confining pressure is allowed to dissipate. Otherwise the effective stress on the soil is the confining pressure (or total stress) minus the pore water pressure which exists in the soil.

During the shearing process, the soil sample experiences axial strain, and either volume change or development of pore water pressure occurs. The magnitude of shear stress acting on different planes in the soil sample is different. When at some strain the sample fails, this limiting shear stress on the failure plane is called the shear strength.

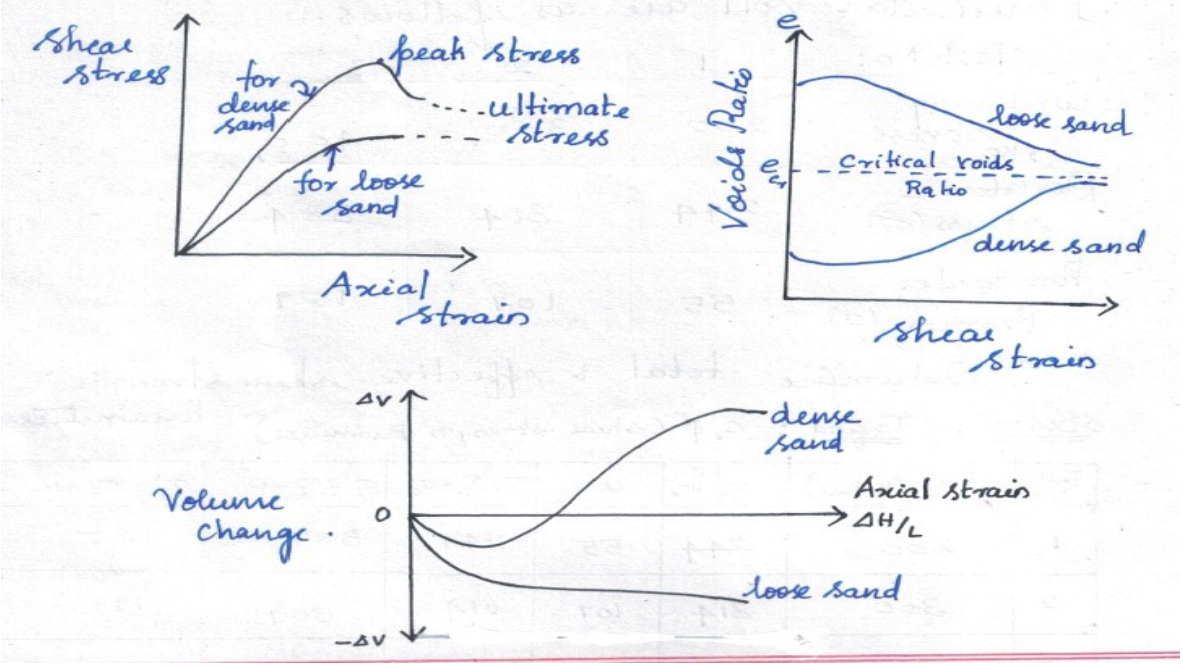
14.Give Columb's shear strength equation and shear strength parameters(MayJune2016)

$$S \text{ or } \tau = C + \sigma \tan \phi$$

C- Cohesion ϕ - Angle of internal friction (or) Angle of shearing resistance respectively.

C& ϕ are the shear strength parameters.

12.Sketch the stress-strain & volume change relationship for dense and loose sand (April May 2017)



15.Define stress path (MayJune2016)(April May 2011)

Stress path is the curve or a straight line which is the locus of a series of stress points depicting the changes in stress in a test specimen or in a soil element in-situ during loading and unloading.

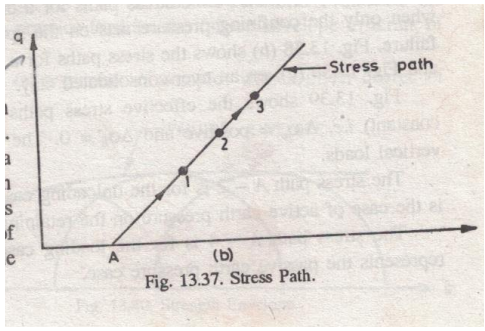


Fig. 13.37. Stress Path.

17. Write down the expression to determine the shear strength of soil by vane shear test (MayJune2013)

PARTIALLY SUBMERGED VANE

$$\tau_f = \frac{T}{\pi d^2\left[\frac{H}{2}+\frac{d}{12}\right]}$$

FULLY SUBMERGED VANE

$$\tau_f = \frac{T}{\pi d^2\left(\frac{H}{2}+\frac{d}{6}\right)}$$

18.What are the advantages of Vane shear test? (April May 2011)

- The test is simple and quick.
- It is ideally suited for the determination of in-situ undrained shear strength for fully saturated clay.
- The test can be conveniently used to determine the sensitivity of the soil

19. What are the disadvantages of Vane shear test?

- The test cannot be conducted on the fissured clay or the clay containing sand or silt laminations.
- The test does not give accurate results when the failure envelope is not horizontal

20.Name the types of shear tests that are developed based on the drainage conditions(Nov Dec 2010)

- Unconsolidated- Undrained condition.
- Consolidated-Undrained condition.
- Consolidated-Drained condition.

23) Define sensitivity and thixotropy for a soil (Nov Dec 2017)

Sensitivity

Sensitivity, S_t is defined as the ratio of unconfined compressive strength of clay in undisturbed state to unconfined compressive strength of a same clay in remoulded state at unaltered water content.

$$\text{Sensitivity} = \frac{Q_u \text{ (undisturbed)}}{Q_u \text{ (remoulded (or) disturbed)}}$$

Thixotropy

Soil loose its strength under remoulding. The term thixotropy is related to remoulding. The strength loss is due to alteration of soil structure disturbance of water molecules that were in adsorbed condition

But this change in remoulding is not one way. Sometimes this alternation are observed reversible. If such soil is allowed to rest unaltered in respect of water loss, it is observed that it regains strength to some extent. When the gaining of strength of soil with course of time after it get remoulded is known as thixotropy.

24.Name the different test to determine shear strength of soil?

- Direct shear test
- Vane shear test
- Unconfined compression test
- Triaxial compression test

25.What are the merits of unconfined compression test(UCC)?

- The test is convenient, simple and quick.
- It is ideally suited for measuring the unconsolidated-undrained shear strength of intact, saturated clays.
- The sensitivity of the soil may be easily determined by conducting the test on an undisturbed sample &then on the remoulded sample.

26. What are the demerits of unconfined compression test(UCC)?

- The test cannot be conducted on fissured clays
- The test may be misleading for soils for which the angle of shearing is not zero.For such soils ,the shear strength is not equal to half the compressive strength.

27. What are the Parameters affecting the shear strength of cohesion less soils?

i) Shape of particles ii) Gradation
iii) Density iv) Confining pressure
v) Deviator stress vi) Loading
vii) Type of minerals viii) Moisture

28. What are the Parameters affecting the shear strength of cohesive soils?

i)Structure of clay ii) clay content
iii)Drainage conditions iv) Rate of strain
v)Intermediate principle stress vi)Repeated loading
vii)Confining pressure viii)Plasticity index
ix)Stress history x) Disturbance

29.What Are The Advantages Of The Triaxial Test Over The Direct Shear Test?

- The soil samples are subjected to uniform stresses and strains.
- Different combinations of confining and axial stresses can be applied.
- Drained and undrained tests can be carried out.
- Pore water pressures can be measured in undrained tests.
- The complete stress-strain behaviour can be determined.

Unit 5

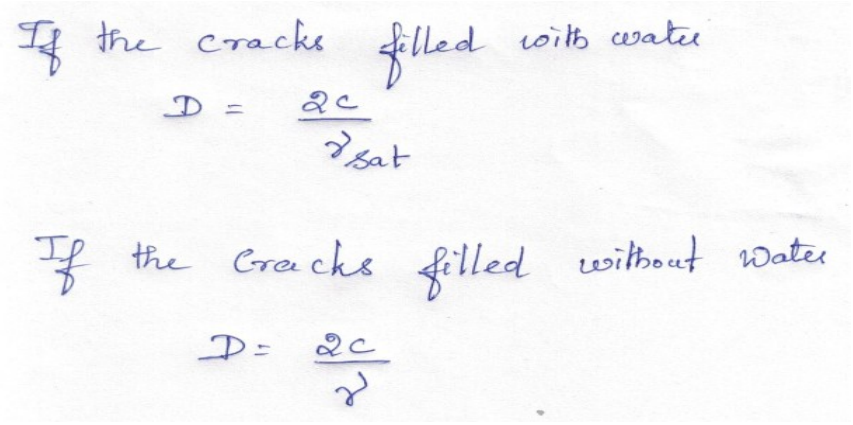
1)Find the FOS of an infinite slope having a slope angle of 30º .The slope consists of cohesionless soil with angle of internal friction 36º

Factor of safety, $F = \frac{\tan \phi}{\tan i}$

$= \frac{\tan 36}{\tan 30}$

$= 1.25$

3)State the influence of tension cracks in factor of safety if the cracks are filled with water and without water (April/May 2015)



4)How Taylor stability Number is utilised for slope stability analysis?/ Uses of stability number (April/May 2015)(MAY JUNE 2010)

- If the slope angle and mobilised friction angle are known stability number can be obtained knowning unit weight and height of slope ,cohesion can be got.
- Knowing the height of slope , unit weight of earth and desired factor of safety , stability number can be evaluated. The slope angle can be found for the angle of internal friction.

5)What are the factors leading to the failure of slopes (May June 2016)

- Gravity can be divided into components acting parallel to a slope and perpendicular to the slope.
- Failure is more likely to occur if the effect of friction on the potential sliding surface is reduced.
- The physical properties of the slope materials such as cohesion between grains may reduce the potential for slope failure.
- The angle of repose is the maximum slope generated when loose unconsolidated material is formed into a pile.
- The addition of excess water may destabilize slopes by adding weight, destroying cohesion between grains, and reducing friction

6)What are the three forces acting in circular failure while analyses through friction cicle method (May June 2016)

- Weight of wedge (W)
- Total frictional resistance or Resultant (R)
- Total cohesive resistance CL Developed along slip circle

7)Mention different modes of slope failure (April/May 2017)

1. Face (Slope) failure
2. Toe failure
3. Base failure

8)Define finite slopes (Nov/Dec 2017)

A finite slope is limited in extent and the properties of soil will not be the same at identical depths so that the slip surface will be curved. The inclined face of earth dam, embankments are the examples for finite slopes.

9) Define infinite slopes

The term infinite slope is used to designate as a constant slope of infinite extent in very large and the properties of soil will be the same at identical depths so that the slip surface will be plane parallel to the surface of slope. The long slope of a mountain is an example of infinite slopes.

10)Write the formula for finding factor of safety with respect to cohesion and friction(Nov/Dec 2017)

- factor of safety with respect to friction

$$F\varphi = \frac{\tan\varphi}{\tan\varphi m} = \frac{\varphi}{\varphi m}$$

ϕ - Angle of internal friction

ϕ_m- Angle of internal friction

- factor of safety with respect to cohesion

$$F_C = \frac{C}{C_m}$$

11)What are the factors leading to the failure of slopes (May June 2016)

- Action of gravitational forces
- seepage force within the soil
- Excavation or undercutting of its foot

12)What are different types of slope failure with neat sketch. /
Differentiate mode of failure of finite and infinite slopes(April/May 2015)

Face failure

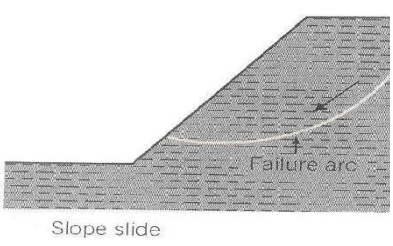
Failure occurs along a surface of sliding that intersects the slope at or above its toe, the slide is known as slope or face failure

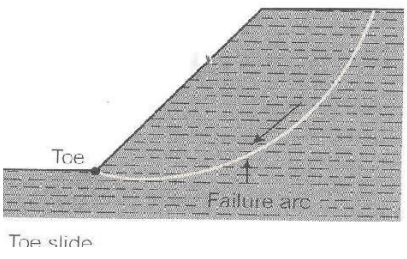
Toe failure

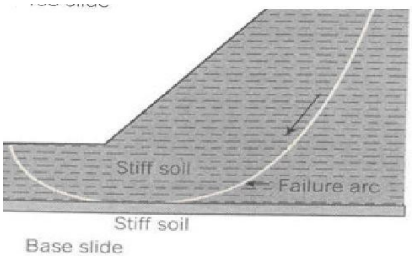
If the failure arc is passes through the toe , the failure is called toe failures. This occurs when the slope is steep and homogeneous.

Base failure

In this case the failure surface passes
below the toe. This generally occurs when the soil below the toe is relatively weak and soft.

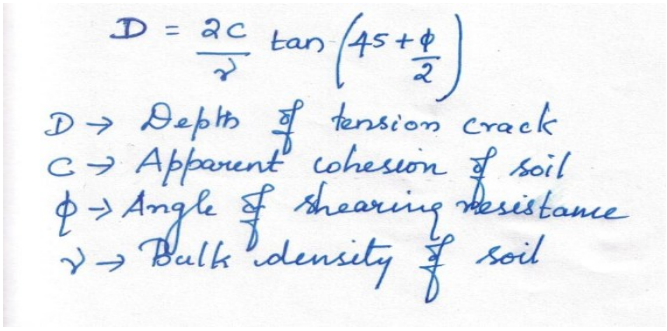






13)Define Tension cracks (MAY JUNE 2010)

Usually the soil at the top of the slip circle fails in tension tesulting in formation of tension cracks or deep fissures.
According to terzaghi ,the maximum depth of crack which occur is given by the expression

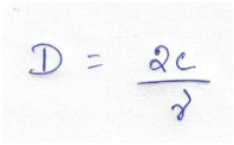


14)What are the three conditions for which stability analysis of an earth dam is carried out?

- Sudden draw down
- Steady seepage
- End of construction

15)What do you mean by tension cracks? (May /June 2010)

when slip is emminent in cohesive soil there will always develop a tension crack on the top of the surface of the slope along which ,no shear resistance can develop.
The depth of tension crack is given by,



2)What is the effect of depth of failure surface on the stability of infinite slope in cohesionless soil (April/May 2015)