FOUNDATION ENGINEERING
UNIT -1 SITE INVESTIGATION & SELECTION OF FOUNDATION

1. What are components of total foundation settlement?

Elastic settlement, consolidation settlement, secondary consolidation settlement.

2. What are the types of shear failure?

General shear failure, local shear failure, punching shear failure.

3. What are assumptions in Terzaghi's bearing capacity theory?

- The base of the footing is rough.
- The load on footing is vertical and uniformly distributed.
- The footing is continuous.

4. List out the methods of computing elastic settlements?

Based on the theory of elasticity, Pressure meter method, Janhu Bjerram method, Schmentmann's method.

5. What are the limitations of Terzaghi's analysis?

As the soil compresses, pi changes slight down ward movement of footing may not develop fully the plastic zones

Error due to assumption that the resultant passive pressure consists of three components is small.

6. Define ultimate bearing capacity?

Gross pressure at the base of the foundation at which the soil fails in shear is called ultimate bearing capacity.

7. Define net ultimate bearing capacity?

Net pressure increase in pressure at the base of the foundation that causes failure in shear, is called as net ultimate bearing capacity

8. Define allowable bearing capacity?

It is the net loading intensity at which neither the soil fails in shear nor there is excessive settlement detrimental to the structure

9. Write the expression for correction due to dilatancy submergence?

$Ne = 15 + (N_o\text{-}15)$

10. What are the requirements for a stable foundation?

- Must be safe from failure.
- Must be properly located.
- Must not settle or deflect sufficiently to damage the structure or impair its usefulness.

11. What are the factors which depends depth?

Type of soil, size of structure, magnitude of loads, environmental conditions, etc

12. Define net pressure intensity?

It is the excess pressure, of the gross pressure after the construction of the structure and the original overburden pressure.

13. What are the zones used in the Terzaghi's bearing capacity analysis for dividing the failure envelope of the soil?

Elastic equilibrium zone, Radial Stress zone, plastic zone.

14. Write the ultimate bearing capacity equation for the general shear failure of soil in Terzaghi's analysis for a strip footing.

$$qu = CNc + QNq + 0.5\ \gamma B\ N_\gamma$$

15. Define Shallow foundation.

If the depth of the foundation is less than its breadth, such foundation is known as shallow foundation.

16. When will the total settlement be completed in the case of cohesion-less soil?

Once the construction is over, the total settlement is assumed to be completed.

17. Define differential settlement

If any two points of the foundation base experiences different settlements then such settlement is known as differential settlement.

18. What type of shear failure of soil is more likely to happen in the case of very dense soil?

Usually punching shear failure and local shear failure may also be possible.

19. Write the ultimate bearing capacity equation for the general shear failure of soil in Terzaghi's analysis for a square footing.

$qu = 1.3\ CNc + QNq + 0.4\ \gamma B\ N_{\gamma}$

20. When will the Consolidation settlement get completed?

In the case of cohesion-less soil, the consolidation settlement gets completed once the construction is over. But In the case of cohesive soil, the consolidation settlement takes place for several years.

21. Define Deep foundation

If the depth of the foundation is equal to or greater than the breadth of the foundation such foundation is called as deep foundation.

22. For which type of foundation, Terzaghi's bearing capacity equation is applicable, why?

Shallow foundation only. Because the effect of the depth is not considered.

UNIT -2 SHALLOW FOUNDATION

1. What is the information obtained in general exploration?

Preliminary selection of foundation type, depth of water, depth, extent and composition of soil strata engineering properties required disturbed or partly disturbed samples approximate values of strength and compressibility.

2. Define significant depth?

Exploration depth, in general it should be carried out to a depth upto which increase in the pressure due to structural loading is likely to cause shear failure, such depth is known as significant depth.

3. What are the types of soil samples?

- Disturbed soil sample
- Undisturbed soil sample

4. What is the difference between disturbed and undisturbed soil sample?

Disturbed soil sample

Natural structure of soils get partly or fully modified and destroyed.

Undisturbed soil sample

Natural structure and properties remain preserved.

5. What are the disadvantages of wash boring?

It is a slow process in stiff soil.

It cannot be used effectively in hard soil, rocks, etc.

6. What are design features that affect the sample disturbance?

Area ratio, inside clearance, outside clearance, inside wall friction, Method of applying force

7. What are the corrections to be applied to the standard penetration number?

- Overburden pressure correction
- Dilatancy correction

8. What are various methods of site exploration?

Open excavation, borings, geophysical methods, sub-surface soundings.

9. What are the methods of boring?

Auger borings, shell boring, wash boring, rotary boring, percussion boring.

10. Define area ratio?

Area ratio is defined as the ratio of maximum cross sectional area of the cutting edge to the area of the soil sample.

11. Define liquefaction of sand?

The mass failure occurs suddenly, and the whole mass appears flow laterally as if it were a liquid such failure is referred to as liquefaction.

12. How will you reduce the area ratio of a sampler?

By increasing the size of the soil sample.

13. Define foundation and enlist the factors adopted to select the foundation.

All structures located on land are supported on foundation at or below the ground surface. There are many types of foundation system and selection of suitable foundation for a given structure depends upon the type of structure and subsurface condition at the proposed site.

14. Categorize the various types of foundations.

In general foundations can be grouped as shallow or deep foundations. The most common type of shallow foundations are spread footing, continuous footing, raft foundations etc. Deep foundations are pile, pies and caisson.

15. Define shallow foundation.

A foundation is usually considered as shallows if rotational bearing failure is possible. It is generally if the depth of foundation is less than one to two times the width of footing.

16. Enlist the two important criteria that a footing must satisfy.

For the satisfactory function, a footing must satisfy the following criteria.

- The foundation must be stable against shear failure
- The foundation must not settle excessively.

There are the two independent requirements.

17. Define the term 'ultimate bearing capacity'(q_f).

The maximum pressure that causes sinking of footing into the soil as a result of shear failure is known as ultimate bearing capacity.

18. What do you meant by ultimate bearing capacity of shallow foundation?

The ultimate bearing capacity of a footing with centre load depends upon the following factors.

1. Unit weight, shear strength and deformation characteristics of soil.
2. Size, shape, depth and roughness, of footing; and
3. Depth of water table and initial stress condition in soil.

19. Enlist the various types of shear failure.

The three principal modes of shear failure under footing are 1. general shear failure 2. Local shear failure 3. Punching shear failure.

20. What do you meant by 'General shear failure?

General shear failure is characteristic of narrow footing of shallow depths resting on strong drive soil that are relatively in compressible.

21. Define the term 'local shear failure'.

For weaker, more compressible soils and wider or deeper footings, the failure can be local shear failure. Local shear failure is characterized by well defined slip lines below the footing but extending only a short distance into the soil mars. The slip surface may appear at the ground surface only after a considerable vertical displacement of the footing.

22. Define the term called 'footings'.

Footing is a type of shallow foundation used to transmit the load of an isolated column of that of a wall to the subsoil. Footing is also defined as the enlarged base of columns of walls. The footings of columns are either square or rectangular.

23. Write the basic design aspects for footing.

The two basic criterions always be used in evaluating loads are as follows:

(i) Determination of the bearing capacity of soil and selection of an adequate factor of safety.

(ii) Estimation of settlement under the expected load and comparison with permissible settlement.

24. Write down Terzhagis safe bearing capacity equation for strip footing.

For strip footing: $q_s = \frac{1}{F}\left[CN_C + \gamma D\left(N_q - 1\right)R_w, +0.5\gamma BN_\gamma R_{w2}\right] + \gamma D$

25. Write down Terzhagis safe bearing capacity equation for square footing.

For square footing: $q_s = \frac{1}{F}\left[1.sCN_c + \gamma D\left(N_q - 1\right)R_w, +0.4\gamma BN_\gamma R_{w2}\right] + \gamma D$

26. Write down Terzhagis safe bearing capacity equation for circular footing.

For circular footing: $q_s = \frac{1}{F}\left[1.3CN_C + \gamma D\left(N_q - 1\right)R_w, +0.3\gamma BN\gamma R_{w2}\right] + \gamma D.$

27. Define the term 'safe bearing capacity (q_s).

The maximum pressure which the soils can carry safely without risk of shear failure is called as safe bearing capacity.

$$q_s = \frac{q_{nf}}{F} + \gamma D, \text{ where F-factor of safety.}$$

UNIT –III FOOTINGS & RAFTS

1. under what circumstances, a strap footing is adopted?

When the distance between the two columns is so great, so that trapezoidal footing is very narrow and so it is uneconomical. It transfers the heavy load of one column to other column.

2. What is a mat foundation?

It is a combined footing that covers the entire area beneath a structure and supports all the walls and columns.

3. Where mat foundation is used?

It is used when the area of isolated footing is more than fifty percentage of whole area or the soil bearing capacity is very poor.

4. Define spread footing?

It is a type of shallow foundation used to transmit the load of isolated column, or that of wall to sub soil. The base of footing is enlarged and spread to provide individual support for load.

5. What are types of foundation?

Shallow foundation, deep foundation.

6. What are the footings comes under shallow foundation?

Spread footing or pad footings, strap footings, combined footings, raft or mat foundation.

7. What are the footings comes under deep foundation?

Pile, caissons (well foundation)

8. Define floating foundation?

It is defined as a foundation in which the weight of the building is approximately equal to the full weight of the soil including water excavated from the site of the building.

9. What is mean by proportioning of footing?

Footings are proportional such that the applied load including the self weight of the footing including soil .the action are not exceeding the safe bearing capacity of the soil.

10. What are the assumptions made in combined footing?

The footing is rigid and rests on a homogenous soil to give rise to linear stress distribution on the bottom of the footing.

The resultant of the soil pressure coincides with the resultant of the loads, then it is assumed to be uniformly distributed.

11. What do you meant by continuous footing?

A spread footing which supports two or more columns is termed as combined footing. Generally, combined footings may be rectangular in shape, if both the columns carry equal loads.

12. What do you meant by strap footing?

When the independent spread footings of two columns are connected by a beam then it is called strap footing.

13. What do you meant by raft footing?

Raft footing also called as mat footing is a combined footing that covers the entire area beneath a structure and supports all the wall and columns. Usually, rafts are designed as reinforced concrete flat slabs.

14. Define truly elastic foundation.

The soil is assumed to be continuous elastic medium obeying Hooke's law.

15. Enlist the methods for the design of raft foundation.

There are two important modes for the design of raft foundation. They are 1. Conventional method 2. Soil line method.

16. Write down the assumptions in conventional method.

1. The soil pressure is assumed to be plane such that the centroid of soil pressure coincides with the line of action of the resultant force of all the loads acting on the foundation.
2. The foundation in infinitely rigid.

17. Define about soil line method.

Solid line method also called as elastic method, in which a number of methods have been proposed based primarily on two approaches of simplified and truly elastic foundations.

18. Define simplified elastic foundation.

The soil in this method is replaced by an infinite number of isolated springs.

UNIT –IV
PILES

1. List out the type of pile based on material used?

Timber pile, concrete pile, steel pile, composite pile.

2. How is the selection of pile carried out?

The selection of the type, length and capacity is usually made from estimation based on the soil condition and magnitude of the load.

3. What is mean by group settlement ratio?

The settlement of pile group is found to be many times that of a single pile. The ratio of the settlement of the pile group to that of a single pile is known as the group settlement ratio.

4. What are the factors consider while selecting the type of pile?

- The loads
- Time available for completion of the job
- Availability of equipment
- The ground water conditions
- The characteristics of the soil strata involved.

5. What are the types of hammer?

Drop hammer, diesel hammer, double acting hammer, Single acting hammer, vibratory hammer.

6. What is pile driver?

Piles are commonly driven by means of a hammer supported by a crane or by a special device known as a pile driver.

7. What are methods to determine the load carrying capacity of a pile?

1) Dynamic formulae. 2) Static formula.
3) Pile load test. 4) Penetration tests.

8. What are the two types of dynamic formulae?

Engg. news formula
Hiley's formula

9. What is meant by single-under reamed pile?

The pile has only one bulb is known as single under reamed pile.

10. Write down the static formulae?

The static formulae are based on assumption that the ultimate bearing capacity Qup of a pile is the sum of the ultimate skin friction Rf and total ultimate point or and bearing resistance Rp.

$$Qup=Rf+Rp$$
$$Qup=Asrf+Ap.rp$$

8. Define compaction pile.

To compact loose granular soils and to increase the bearing capacity, compaction piles are used.

9. Where do we use anchor piles?

Anchor piles are used to provide anchorage against horizontal pull from sheet pile walls or other pulling forces.

10. Where batter piles are used?

Batter piles are used to resist horizontal force or inclined force due to moving or berthing ships.

11. What is the advantage of fender piles and dolphins?

They protect water font structures against the impact from ships or other floating objects.

12. What do you meant by pile capacity?

The capacity of individual pile can be estimated by static formula, dynamic formula, pile load test or standard penetration test. The most reliable method of estimating pile capacity is through the pile load test.

13. What do you meant by static formulae?

The static formulae are used to estimate pile capacity on the basis of strength properties of soil. The ultimate load capacity of piles can be estimated by calculating the resistance derived from the end bearing and friction component of total pile capacity.

14. What do you meant by dynamic formulae?

Dynamic formulae are generally used to establish pile driving criteria for pile installation. The load capacity of pile often estimated from the resistance of pile to penetration during driving.

15. In general, define the term called pile.

A pile is a small diameter shaft driven or installed into the ground through suitable technique. Piles generally obtain support from a combination of friction along the surface of pile shaft and from end bearing at the bottom of shaft.

16. Write down the various mode of classification of piles.

Piles are severally classified based on (i) function (ii) method of installation (iii) based on material.

17. How will you classify the pile based on function?

Based on function, (a) End bearing piles (b) Friction piles (c) Compaction piles (d) Tension piles (e) Anchor piles (f) Batter piles (g) Fender piles and dolphins.

18. How will you classify the piles based on installation?

Based on method of installation: 1. Precart driven piles 2. Driven cart insitu piles 3. Bored cart insitu piles.

19. Classify the pile based on material.

Based on material: 1. Concrete piles (Precast and cast insitu piles) 2. Timber piles 3. Steel piles 4. Composite piles (concrete, timber, steel piles).

20. Define about end bearing piles.

End bearing piles also known as point bearing piles. If the load is transferred to hard strata through water or soft soils, they are called as end bearing piles.

21. Define the term friction piles.

Friction piles can be skin friction piles. If the load is transferred by means of friction (skin friction) along the surface of the soil, it is called as friction pile.

22. Define modulus of sub grade reaction?

The ratio of soil reaction (p) to the deflection (y) at any point is defined as the modulus of sub grade reaction Es or soil modulus.

UNIT –V RETAINING WALLS

1. Define conjugate stresses?

The stress acting on the conjugate planes is called conjugate stresses.

2. How do you check the stability of retaining walls?

- The wall should be stable against sliding
- The wall should be stable against overturning
- The base of the wall should be stable against bearing capacity failure.

3. Define angle of repose.

Maximum natural slope at which the soil particles may rest due to their internal friction, if left unsupported for sufficient length of time.

4. Define theory of plasticity?

The theory on which the condition of the stress in a state of a plastic equilibrium is called as theory of plasticity.

5. What is assumption in coulomb wedge theory?

The backfill is dry, cohesion less, isotropic, homogenous,

The slip surface is plane which passes through the head of the wall.

6. How to prevent land sliding?

Sheet piles, retaining wall may be used to prevent the land sliding.

7. Write down any two assumptions of Rankine's theory?

- Semi infinite soil
- Cohesion-less backfill
- Homogenous soil
- The top surface is a plane which may be inclined or horizontal.

8. Distinguish Coulomb's wedge theory from Rankine's theory?

Rankine considered a soil particle at plastic equilibrium but Coulomb considered the whole soil mass.

9. Define backfill.

The material retained or supported by the structure is called backfill which may have its top surface horizontal or inclined.

10. Define Surcharge.

The position of the backfill lying above a horizontal plane at the elevation of the top of a wall is called surcharge and its inclination to the horizontal is called surcharge β.

11. Write down Mohr coulomb equation?

The stress condition during plastic equilibrium can be represented by the following Mohr coulomb equation:

$$\frac{\sigma_1 - \sigma_3}{2} - \frac{\sigma_1 + \sigma_3}{2}\sin\phi = c\cos\phi$$

$$(or)$$

$$\sigma_1 = 2c\tan\left(45° + \phi/2\right) + \sigma_3 \tan^2\left(45 + \phi/2\right)$$

12. Write down Kotters equation.

Kotters gives the solution of which for a given boundary condition gives the orientation of slip lines together with the condition gives the orientation of slip lines together with the stress at each paint of failure zone which is given by.

$$\frac{\partial \sigma_x}{\partial x} + \frac{\partial \tau_{xz}}{\partial z} = 0$$

$$\frac{\partial \tau_{xz}}{\partial x} + \frac{\partial \sigma_z}{\partial z} + \gamma = 0$$

13. Define the term failure wedge.

During the active state, the wall moves away from backfill and a certain portion of the backfill located immediately behind the wall breaks away from the rest of the soil mass. This wedge shaped portion of the backfill tending to move with the wall is called failure wedge.

14. Write the assumptions of Rankines theory.

1. The soil mass is semi-infinite, homogenous, dry and cohesionless
2. The ground surface is a plane which maybe horizontal a inclined.
3. The wall yield about the base and thus satisfies the deformation condition for plastic equilibrium.

15. List down the cases of cohesionless backfill.

1. Dry or moist backfill with no surcharge
2. Submerged backfill
3. Backfill with uniform surcharge
4. Backfill with sloping surface
5. Inclined back and surcharge.

16. Define active earth pressure.

If the earth pressure does not decrease beyond this point with the further movement of wall. This minimum pressure is called active earth pressure.

17. Define passive earth pressure.

If any further movement of wall does not increase the pressure. This maximum pressure is called passive earth pressure.

18. List out the conclusions drawn by lambe for dense sand.

(i) Very little horizontal strain, less than -0.5 %, is required to reach the active state.
(ii)Little horizontal compression about 0.5% is required to reach 1.5 of maximum passive resistance.
(iii) Much more horizontal compression, about 2% is required to reach the full maximum passive resistance.

19. List out the conclusions drawn by lamb for lone sand.

(i) The horizontal compression required to reach full passive resistance may be as large on 15%
(ii) Very little horizontal strain, less then – 0.5%, is required to reach the active state.
(iii) Little horizontal compression about 0.5% is required to reach 1.5 of maximum passive resistance.

20. List out the assumptions of wedge theory.

1. The backfill is dry, cohesionless, homogenous, intropic and elastically undefermable but breakable.
2. The slip surface is plane which panel, through the heel of the wall.
3. The sliding wedge itself acts as a rigid body and the value of earth pressure is obtained by considering the limiting equilibrium of the sliding wedge as a whole.

SIXTEEN MARK QUESTIONS

UNIT -I

1. Explain any two methods of site exploration in detail?
2. Explain wash boring method of soil exploration?
3. Explain the arrangements and operations of stationary piston sampler?
4. Explain about standard penetration test?
5. Explain any two important types of samplers.
6. Explain with neat sketch auger boring method of soil exploration.
7. Explain dynamic cone penetration test.
8. Describe the salient features of a good sub-soil investigation report?

UNIT -II

1. What is shallow foundation? Explain its types?
2. What is settlement? What are the components of settlement? Distinguish between them?
3. Explain the test to be conducted for find out the bearing capacity?
4. What is bearing capacity? What are the factors affecting bearing capacity? what are improving factors of bearing capacity?
5. A Strip footing of width 3m is founded at a depth of 2m below the ground surface in a (c-_) soil having a cohesion c = 30 kN/m2 and angle of shearing resistance _ = 35o. The water table is at a depth of 5m below ground level. The moist weight of soil above the water table is 17.25 kN/m2. For _ = 35o, Nc = 57.8, Nq = 41.4 and N_ = 42.4 Determine (i) the ultimate bearing capacity of the soil (ii) the net bearing capacity of soil (iii) the net allowable bearing pressure and the load/m length for a FS = 3. Use the general shear failure theory of Terzaghi.
6. Size of an isolated footing is to be limited to 1.5 metres square. Calculate the depth at which the footing should be placed to take a load of 200 kN, with a factor of safety 3. The soil is having angle of

internal friction _ = 30o. The weight of the soil is 21 kN/m3. Bearing capacity factor for _ = 30o, Nq=22 and N_ = 20.

7. Calculate the settlement of a structure founded on a clay. Thickness of clay stratum is 6m at 10m below from the ground level. The overlaying layer is sand upto ground level. Water table is at 6m from the ground level. Unit weight of sand above the water table is 18 kN/m3 and below water table it is 21 kN/m3. Specific gravity of the clay is 2.75, natural moisture content of the clay is 40% and its liquid limit is 45%. Increase in overburden pressure at the centre of the clay structure, due to proposed construction of the building is 100 kN/m2.

8. Explain Terzaghi's analysis of bearing capacity of soil in general shear failure.

9. A Strip footing of width 3m is founded at a depth of 2m below the ground surface in a (c-_) soil having a cohesion c = 30 kN/m2 and angle of shearing resistance _ = 35o. The moist weight of soil above the water table is 17.25 kN/m2.

For _ = 35o, Nc = 57.8, Nq = 41.4 and N_ = 42.4

For _ = 25o, Nc = 25.1, Nq = 12.7 and N_ = 9.7

The water table is at a depth of 5m below ground level. Determine

(i) the ultimate bearing capacity of the soil

(ii) the net bearing capacity of soil

(iii) the net allowable bearing pressure and the load/m length for a FS = 3.

Assume the soil fails in local shear .

10. A Strip footing of width 3m is founded at a depth of 2m below the ground surface in a (c-_) soil having a cohesion c = 30 kN/m2 and angle of shearing resistance _ = 35o. The moist weight of soil above the water table is 17.25 kN/m2. For _ = 35o, Nc = 57.8, Nq = 41.4 and N_ = 42.4 For _ = 25o, Nc = 25.1, Nq = 12.7 and N_ = 9.7 If the water table occupies any of the positions

(i) 1.25 m below Ground Level or

(ii) 1.25 m below the base level of the foundation,

What will be the net safe bearing pressure?

Assume _sat = 18.5 kN/m3, _ (above WT) = 17.5 kN/m3, Factor of Safety = 3

11. Explain different types of shear failures of soil with neat sketch

12. Compute the consolidation settlement by oedometer test data method

13. A footing rests at a depth of 1m has a size of 3m x 1.5m and it causes a pressure increment of 200 kN/m2 at its base. The soil profile at the site consists of sand for the top 3 m, which is underlined by a clay layer of 3m. Water table is at a depth of 2.5m from the ground surface. The unit weight of sand layer above and below water table are 16kN/m3 and 18 kN/m3 respectively. The unit weight of clay is 15 kN/m3. The initial void ratio is 0.8 and compression index is 0.3. Determine the consolidation settlement at the middle of the clay layer. Assume 2:1 pressure distribution and consider the variation of pressure across the depth of the clay layer.

14. Compute the safe bearing capacity of a square footing 1.5 m x 1.5 m located at a depth of 1 m below the ground level in a soil of average density 20 kN/m3. _ = 20°, Nc = 17.7, Nq = 7.4 and N_ = 5. Assume a suitable factor of safety and that the water table is very deep. Also compute the reduction in safe bearing capacity of the footing if the water table rises to the ground level.

UNIT -III

1. What are the different types of raft foundations?

2. State the design requirement of a foundation?

3. Briefly explain about the structural design of spread footing

4. Briefly explain how proportioning and structural design of trapezoidal combined footing is done with diagram

5. Derive the relation between the dimensions of trapezoidal combined footing and unequal column loads Q1 and Q2?

6. A trapezoidal footing is to be produced to support two square columns of 30 cm and 50 cm sides respectively. Columns are 6 meters apart and the safe bearing capacity of the soil is 400 kN/m2. The

bigger column carries a load of 500 kN and the smaller carries a load of 3000kN. Design a suitable size of the footing so that if does not extend beyond the face of the columns.

UNIT -IV

1. Explain the method of determining the load carrying capacity of a pile?
2. What are the cased cast in-situ concrete piles?
3. What are the uncased cast in-situ concrete piles?
4. What are different types of piles and their functions?
5. What is group capacity by different method
6. What are the various factors influencing the selection of pile?
7. Explain briefly cyclic load test on pile.
8. A pile is driven with a single acting steam hammer of weight 15kN with a free fall of 900mm. The final set, the average of the last three blows, is 27.5mm. Find the safe load using the Engineering News formula.
9. A group of 16 piles of 50 cm diameter is arranged with a center to center spacing of 1.0 m. The piles are 9m long and are embedded in soft clay with cohesion 30kN/m. Bearing resistance may be neglected for the piles. Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group.

UNIT -V

1. Explain the active and passive states of earth pressure acting on a retaining wall.
2. Explain the Coulomb wedge theory with neat sketches
3. Explain the Rebhann's graphical method for active earth pressure calculation
4. Explain the Culmann's graphical method and the effect of line load
5. Explain the Rankine's theory for various backfill condition to calculate active state earth pressure.
6. A retaining wall is 4 metres high. Its back is vertical and it has got sandy backfill upto its top. The top of the fill is horizontal and carries a uniform surcharge of 85 kN/m2. Determine the active earth pressure on the wall per metre length of wall. Water table is 1m below the top of the fill. Dry density of soil = 18.5 kN/m3. Moisture content of soil above water table = 12%. Angle of internal friction of soil = 30°, specific gravity of soil particles = 2.65. Porosity of backfill = 30%. The wall friction may be neglected.