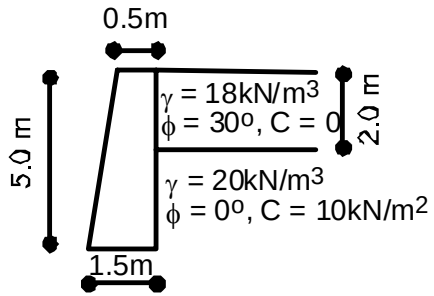
PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2003

LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.
Attempt any FIVE questions.

Q. [1] **[a]** Why is site investigation important? Describe various stages of site investigation. [8]

[b] The details of solids retained behind a masonry wall is given in Fig 1[b]. The block of wall is vertical and smooth. Check the stability of the retaining wall against sliding for a factor of safety of 2.0. The unit weight of the wall is 24.0 kN/m^3 and coefficient of base friction is 0.65. [8]



Q. [2] **[a]** What assumptions are made by coulomb while determining earth pressure theory ……explain how active earth pressure is determined by coulomb's wedge theory. [8]

[b] A rectangular footing size 1m×2m is placed at a depth of 1.5m below ground level. Calculate safe being capacity for a factor of safety 3.0, using Skempton's method and Terzaghi's method. The soil properties are unit weight above water table is 18 KN/m^3, unit weight below water table is 18 KN/m^3, unit weight above below water table is 20KN/m^3, conesion 20 KN/m^2 and internal friction zero. Water table is located 2m below the ground level. [8]

Q. [3] **[a]** What are the various loads to be considered while designing spread foundation? Also explain the factor affecting footing depth selection. [8]

[b] In what circumstances is a mat foundation more suitable than other shallow foundations? Also describe the various types of mat foundation. [8]

Q. [4] **[a]** What are various components of a well foundation? Also explain their functions. How well foundation is sunk? [8]

[b] A concrete pile of diameter 0.3 m is driven into the ground where the upper layer is 3m thick soft clay and the lower layer is stiff clay. The properties of soft clay are unit weight 18 KN/m^3, unconfined compressive strength 50 kN/m^2 and adhesion factor is 0.45. The properties of stiff-clay are unit weight 20 KN/m^3, unconfined compressive strength 150 KN/m^2 and adhesion factor is 0.9. Determine total length of the pile if the designed load on pile top is 100KN and factor safety is 3.0. [8]

Q. [5] **[a]** Describe pile load test. How bearing cap….determined by pile load test?

[b] An anchored sheet pile is shown in Fig. 5[b]. Compute the embedded length of the sheet pile below dredge line assuming free earth support.

Figure: it is not clear

Q. **[6]** **[a]** What do you mean by bearing capability and net bearing capability? Derive Terazag ….bearing capability equation for a strip foundation.

[b] Calculate the earth pressure per unit length against a 6m high retaining wall when it is pushed towards the backfill. The soil ……the wall has unit weight of 18 KN/m^2 above water able and ……KN/m^2 below water table. Take ø = 30^o, …..= 25 KN/m^2. The backfill carries a surcharge of $10KN/m^2$. Also draw earth pressure diagram. Water table is at depth of 2m below ground level.

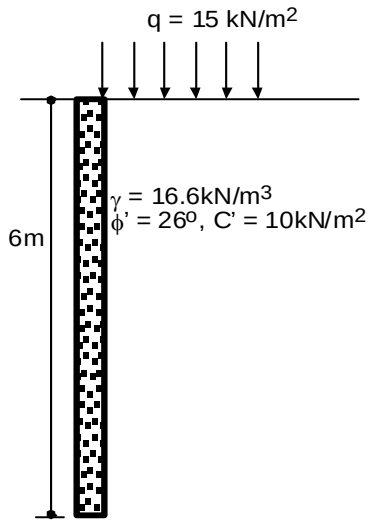
PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2004

LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

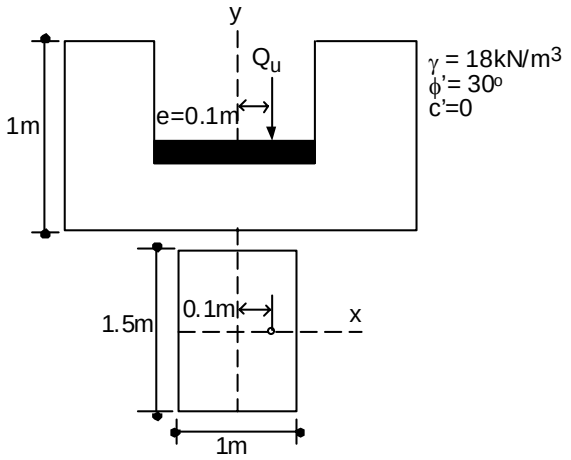
Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.
Assume necessary data if missing.
Attempt any FIVE questions.

Q. [1] **[a]** Describe about the site investigation with its purposes. What are distributed and undistributed samples? [8]

[b] A frictionless wall is shown in the fig. 1[b]. Determine the active force, P_a and the location of p_a after the tensile crack occurs. Also calculate the passive resistance, p_p on the backfill and the location of the resultant passive force. [8]



Q. [2] **[a]** What are the assumption in Coulomb's theory? Briefly compare rankine's theory and Coulomb's theory. Discuss Culmann's method for the determining of active earth pressure. [8]

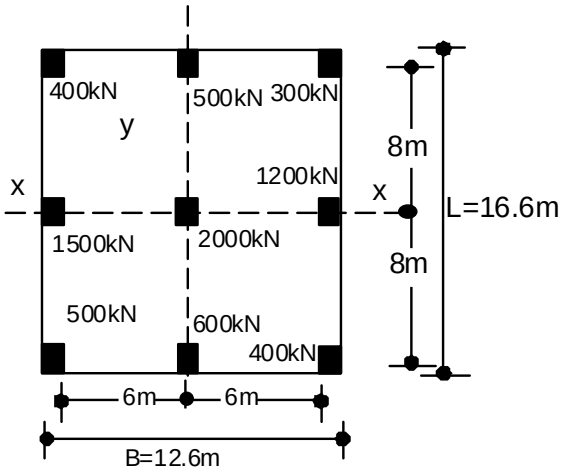


Q. [3] **[a]** A concrete pile, 30cm diameter, is driven into a medium dense sand (ø' = 35°, γ = 21 kN/m^3, K = 1.0, tanδ = 0.70) for a depth of 8m. If the water table is 2m below the ground surface, estimate the safe load taking a factor of safety of 2.50. Take γ_w = 10 kN/m^3. [8]

[b] Describe various methods for the construction of drilled piers. [8]

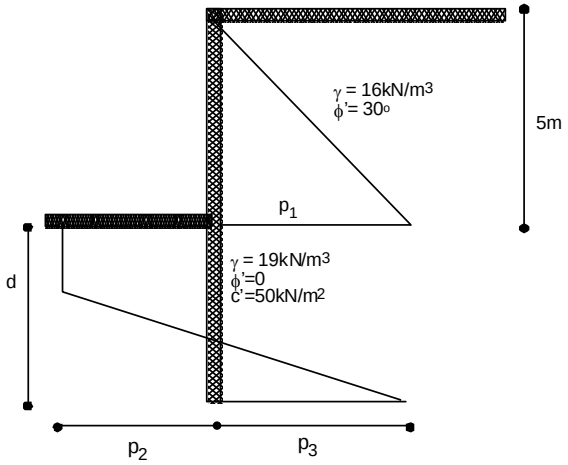
Q. [4] **[a]** What are different types of shallow foundation? Explain the procedure for the design of a spread footing. [8]

[b] The plane of a mat foundation with 9 columns is shown in the Fig. 3[b]. Assume that the mat is rigid, determine the soil pressure distribution. All the columns are of the size 0.6m ×0.6m. [8]



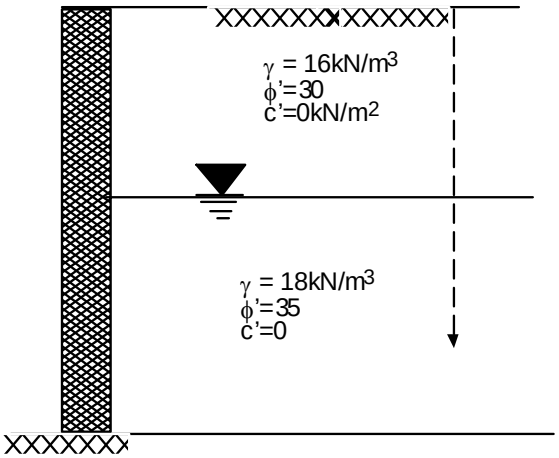
Q. [5] **[a]** What is negative skin friction? What is its effect on the pile? [7]

[b] Determine the depth of embedment 'd' for the cantilever sheet pile shown in the Fig. 5[b]. [9]



Q. [6] **[a]** What are the assumptions made in the derivation of Terzaghi's bearing capacity theory? Write the equation for the ultimate bearing capacity. [8]

[b] Determine the active earth pressure and the total active force on the retaining wall shown in the Fig. 6[b] using Rankine's theory. [8]



PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2005

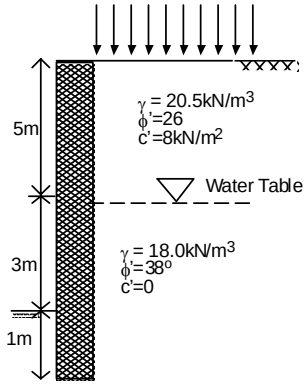
LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.

Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.
Assume necessary data if missing.
Attempt any FIVE questions.

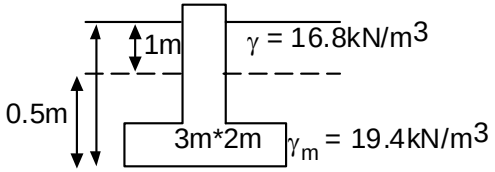
Q. [1] **[a]** Kathmandu municipality is planning to construct an outer ring road in the valley. For the purpose, a detailed soil survey has to be conducted. As a geotechnical engineer, what will be your recommendation regarding the types of sample to be collected during subsurface exploration? What kind of tests you are going to perform with the recommended soil samples in the laboratory for the design of ring road? [8]

[b] Details of smooth and vertical retaining walls are shown in fig 1[b]. The horizontal stress in the soil is such that it is always less then the vertical stress through out the height of the retaining wall. Estimate the total force per meter acting behind the wall. [8]



Q. [2] **[a]** Derive the relation between the horizontal and vertical intergrandular pressures for the Rankine's active state. [8]

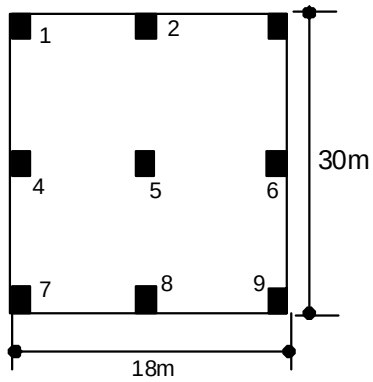
[b] A column foundation fig. 2[b] is 3m×2m plan. Given: Depth of foundation , D_f = 1.5m, angle of internal friction, ø = 25°, cohesion, c = 50 kN/m^2. Using general bearing capacity equation and factor of safety equal to 4, determine the net allowable load the foundation could carry. [8]



Q. [3] **[a]** Where do you provide a combined footing? Discuss the procedure for the design of the trapezoidal footing. [8]

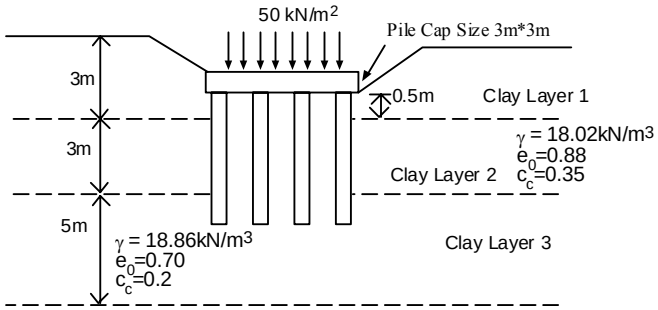
[b] The mat has dimension 18m ×30m as shown in fig 3[b]. The dead load and live load acting vertically and axially on each column are also shown in the same figure. The mat is placed on the saturated clay having a unit weight of 18.90kN/m^3 and c_u = 134kN/m^2 . If the depth of fond dation is equal to 1.50m, determine the factor of safety against bearing capacity failure. [8]

Column	DL (kN)	LL (kN)
1	100	60
2	180	120
3	190	130
4	180	120
5	360	200
6	400	240
7	190	120
8	400	250
9	440	300



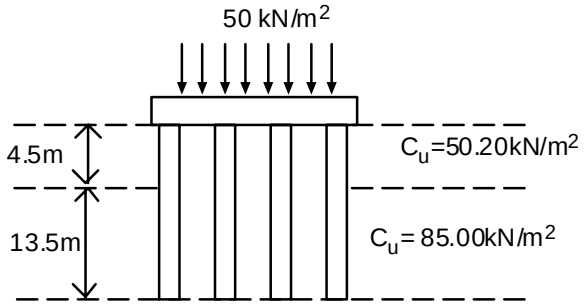
Q. [4] **[a]** What are the various components of a well foundation ? Describe their uses in detail. [8]

[b] A group pile in clay is shown in fig. 4[b]. Determine the consolidation settlement of the, pile groups. All clay layers are normally consolidated. Assume suitable data, if necessary. [8]



Q. [5] **[a]** What do you mean by anchored sheet piled wall? Explain with neat sketch. Obtained an expression for the determination of penetration depth of an anchored sheet pile in sandy soil using free earth support method. **[8]**

[b] The section of a 3×4 group pile in a layered saturated clay is shown in fig. 5[b]. The piles are square in cross-section (350mm ×350mm). The center to center spacing of the piles is 890mm. Determine the allowable load bearing capacity of the pile group. Use factor of safety equals to 4. [8]



Q. [6] **[a]** Explain what do you mean by soil stabilization? Discuss the various methods of soil stabilization. [8]

[b] A long footing is placed over a homogeneous soil mass at some depth. It is assumed that as the load on the footing increases, the failure surface in the soil below the foundation extends upto the ground surface. By appropriately dividing the failure area into elastic zone, radial shear zones and Rankine passive shear zones, derive the equation that can be used to determine bearing capacity of the long footing. [8]

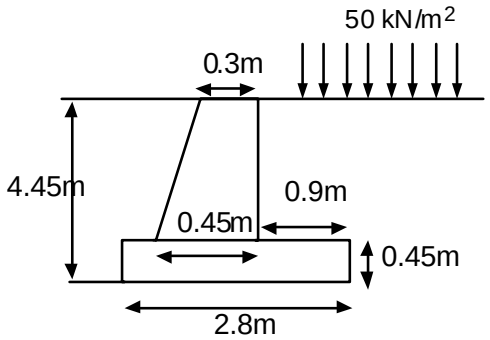
PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2006

LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.
Assume necessary data if missing.
Attempt any FIVE questions.

Q. [1] **[a]** Sketch the longitudinal section of an undisturbed sampling tube and indicate the different parts of the tube. State the necessary requirement of an undisturbed sampling tube. [7]

[b] Determine the maximum and minimum pressure under the base of the cantilever retaining wall as shown in figure and also the factor of safety against sliding and overturning. The appropriate shear strength parameters for soil are c=0 , ø = 40°. The unit weight of soil and concrete are 18KN/m^3 and 24 KN/m^3 respectively. Take δ = 25°. [9]



Q. [2] **[a]** What are the factors that affect the bearing capacity of the soil? What will be the change in the bearing capacity of the soil with change in the water table? Describe with the help of bearing capacity equation. [8]

[b] How does an active state of earth pressure differ form its passive state? Derive the theoretical expression for the calculation of active and passive lateral earth pressures using Mohr's envelope. [8]

Q. [3] **[a]** Describe the design procedure of designing the mat foundation. [8]

[b] A client wants to construct a circular footing of 1m diameters to transfer the load of 1200KN with the safety factor of 2.5 to soil strata with an angle of shearing resistance 30°C, cohesion 10KN/m^2 and unit weight of 18kN/m^3. Suggest the client what should be the depth of footing. Take Terzaghi's bearing capacity Nc, Nq and Nγ as 37.2, 22.5, 19.7 respectively.

Q. [4] **[a]** A concrete pile of 0.3m diameter is driven into the ground where the upper layer is cohesionless sand of 4m thickness and the lower layer is stiff clay. The friction angle of sand is 32° and the bulk unit weight is 19KN/m^3. Coefficient of lateral earth pressure (k) is 1.0 and friction angle between pipe and soil is 0.75 times the friction angle of soil. The unconfined compressive strength of stiff clay is constant through out the depth, equal to 120KN/m^2 and bulk unit weight is 20KN/m^3. Using the adhesion factor of 0.8 determine the total length of pile if the allowable load on the pile is designed to be 100KN and safety factor is 2.5. The water table is 1m below the ground surface. [8]

[b] What are the differences between piers and cassions? How can the piers be constructed by manual method? [8]

Q. [5] **[a]** ……15m….12m in plan has its base 2m below surface of deposit of clay with a unit weight of 16KN/m^3. The unconfined compressive strength of clay is 100kN/m^3. The factor of safety against bearing capacity failure

must be 3.0. What total weight of building plus the foundation can safely by supported by the raft? [8]

[b] How do you classify the pile foundation on the basis of (a) materials (b) method of installation (c) load transfer ? Define negative skin friction with its effect on the piles. [8]

Q. [6] [a] What are the various methods of removing ground water form construction sites ? Describe three prominent methods of foundation soil stabilization. [8]

[b] A cantilever sheet pile wall is driven into sand deposit having friction angle 35^o and bulk unit weight of $22KN/m^3$. Once side of the sheet pile was backfilled to 3m height. The backfill material is cohensionless sand having friction angle 32^o and bulk unit weight of $18KN/m^3$. Using simplified method determine the deposit of penetration needed for the sheet pile to retain backfill. Provide the safety factor of 2.0 for the passive region. The water table is below the base of the sheet pile. [8]

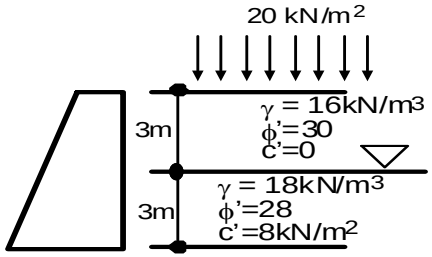
PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2007

LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side.
Assume necessary data if missing.
Attempt any FIVE questions.

Q. [1] **[a]** What are the objectives of site investigation ? Describe the various stages of site investigation. [8]

[b] The proposed Retaining wall of top width 0.6m and bottom width 4m shown below is to be constructed in masonary of unit weight 24kN/m^3. Determine the minimum pressure under the base of the wall as shown in figure and also the factor of safety against sliding, overturning and bearing. The safe bearing capacity of soil is 150KN/m^2 and coefficient of base friction = 0.6. Assume that water table is at 3m from base of retaining wall. [8]



Q. [2] **[a]** What are the assumptions of Rankine earth pressure theory? Derive the relation for active earth pressure in cohesive soil. [8]

[b] A building owner has planned to construct his house with framed structure with square columns at a depth of 1.5m below the ground. If the column has to carry a load of 800KN, determine the size of the footing required to transfer the load to a soil strata with cohesion 10KN/m^2, angle of internal friction 30^o and unit weight of 20KN/m^3. Use a factor of safety as 3. **Take Terzaghi's bearing capacity factors N_c, N_q, $N\gamma$ are 37.20, 22.50 and 19.70 respectively.** **[8]**

Q. [3] **[a]** What is soil stabilization? What are various methods of soil stabilization? Describe soil-cement stabilization in brief. [8]

[b] A building has to be supported on a R.C raft foundation of dimensions 12m×18m. The subsoil is clay having average undrained shear strength of 60KN/m^2. the pressure on soil due to the weight of building and the loads that it will carry will be 140KN/m^2 at the base of raft. If the unit weight of the excavated soil is 20kN/m^3, at what depth should the bottom of raft be placed to provide a factor of safety of 3 against shear failure? [8]

Q. [4] **[a]** What are the various components of a well foundation? Mention the functions of each component with a neat sketch. [8]

[b] A pile group consists of 9 friction piles of 30cm diameter and 10m length is driven in clay (Undrained shear strength =100 kN/m^2 and γ = 20kN/m^3). [8]

The piles are arranged in square pattern and centre to centre spacing is kept 750mm. Determine the safe load for the pile group. Take factor of safety = 3.0 and adhesion factor = 0.60. [8]

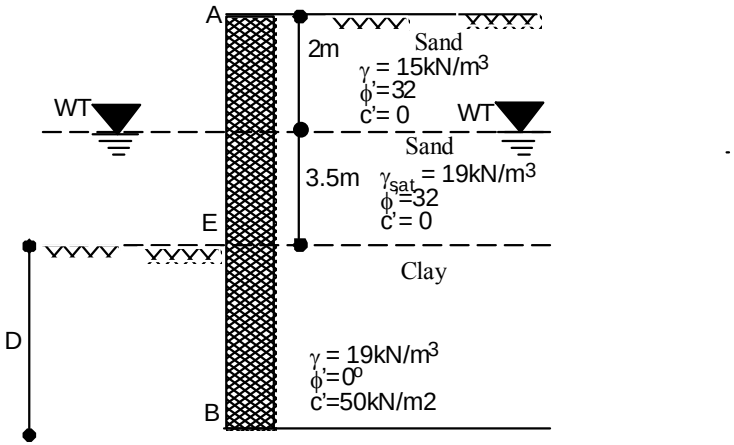
Q. [5] **[a]** Describe the various stages of failure mechanism of foundation soil. Derive an expression for the ultimate

bearing capacity of a strip footing suggested by Terzaghi. [8]

[b] A retaining wall is 7m high, with its back face smooth and vertical. It retains sand with its top surface horizontal. Using Rankiines's theory, determine active earth pressure at the base when the backfill is (a) dry and (b) submerged, with water table at the surface. Take $\gamma = 18KN/m^3$, $\phi = 30^o$ and $\gamma_{sat} = 21\ kN/m^3$. [8]

Q. [6] [a] Describe the pile load test. How bearing capacity is determined by pile load test? [8]

[b] Determine the depth of embedment for the cantilever sheet pile shown in the figure. [8]



PURWANCHAL UNIVERSITY
VI SEMESTER FINAL EXAMINATION-2008
LEVEL : B. E. (Civil)
SUBJECT: BEG359CI, Foundation Engineering.
Full Marks: 80
TIME: 03:00 hrs **Pass marks:** 32

Candidates are required to give their answers in their own words as far as practicable.
All questions carry equal marks. The marks allotted for each sub-question is specified along its side. Assume necessary data if missing.
Attempt any FIVE questions.

Q. [1] **[a]** What are the essential requirement of a good foundation? Write the types of foundation and brief it with neat sketch. [4+4]

[b] A Retaining wall of 8.0 m high has a smooth vertical back. It supports a horizontal backfill with angle of internal friction of 35°C, cohesion of 10 kPa. The water table is at a depth of 3.0m below the surface of backfill. The unit weight of backfill is 17 kN/m^3 above the water table and 19kN/m^3 below the water table. The backfill supports a surcharge of 20kpa. Determine the magnitude and point of action of active earth pressure. [8]

Q. [2] **[a]** What are the factors affecting the bearing capacity of the soil? Describe the effect of water table on bearing capacity of soil with the help of bearing capacity equation. [3+5]

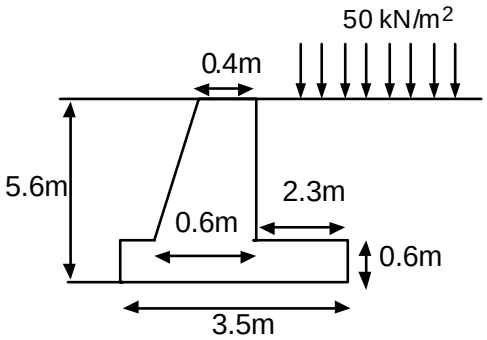
[b] A foundation to carry a column load of 10000 kN is placed 1.0m below the ground level on uniform sand having unit weight, γ = 16 kN/m^3, angle of internal friction, $\phi = 40^o$. Take factor of safety of 3.0. Determine the size of square foundation. Take $N_q = 80$, $N_\gamma = 100$. **[8]**

Q. [3] **[a]** What are the major differences between pile foundation and pier foundation? Write the types of pile foundation based on the function and material with brief description of any three major types. [8]

[b] Explain the design method of mat foundation by using conventional method.

Q. [4] **[a]** Write the assumption made by Karl Terzaghi during the analysis of Bearing Capacity Equation for strip footing. [6]

[b] Check the stability of RCC Retaining wall supporting cohesionless backfill as shown in below fig. Take $\phi = 34^o$, $\delta = 25^o$, $\gamma = 18$kN/m^3 and allowable bearing pressure of 500kpa. Unit weight of R.C.C is 25kN/m^3. **[10]**



Q. [5] **[a]** Write short notes on
[i] Coffer Dam and its type **[ii]** Retaining wall.

[b] In a group of 12 piles each having a diameter of 500mm and 30.0m long. The piles are arranged in 3-rows and spaced at 1.25m. Centre to centre. Take unit weith of soil y' = 11 kN/m^3, unconfined compressive strength q_u = 75kpa, angle of internal friction, $\phi = 0^o$, adhesion factor, $\alpha = 0.8$ and factor of safety, F = 2.5. Determine the safe load carrying capacity of the pile group. [8]

Q. [6] **[a]** What is well foundation? Write types of well foundation. Describe the various components (parts) of the open caisson with neat sketch. [2+2+6]

[b] A 2.5m deep excavation of a trench is carried out in sand is supported by cantilever sheet pile wall. The water table at both side of the sheet pile wall is found at

the bottom of excavation. The bulk unit weight of sand above the water table is 18kN/m^3 and below water table it is 20kN/m^3, ø = 35^{o}C, considering a safety factor as 2.0 for the passive resistance, determine required depth of embedment of the sheet pile. [8]