01 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Foundation Engineering *(CE602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Normal graph paper should be provided.*
- ✓ *Assume suitable data if necessary.*

1. a) How would you select the suitable type of foundation according to soil conditions? [2]
   b) Why undisturbed samples are required? [2]
2. a) In a core of a Kathmandu valley a Geotechnical investigation is to be carried out. As an engineer recommend the type of drilling and the suitable field tests such that the test data can be used as much as possible. [5]
   b) Prepare an example of borehole log format. [3]
3. a) What mathematical procedures are used in checking the stability of retaining wall? Why are retaining walls usually designed for active earth pressure? [2+6]
   b) A trapezoidal masonry retaining wall 1 m wide at top and 3 m wide at its bottom is 4 m high. The vertical face is retaining soil ($\phi = 30°$) at a surcharge angle of 20° with the horizontal. Determine the maximum and minimum intensities of pressure at the base of the retaining wall. Unit weights of soil and masonry are 20kN/m^3 and 24kN/m^3 respectively. Assuming the coefficient of friction at the base of the wall as 0.45, determine the factor of safety against overturning. [8]
4. Explain arching in soils. Explain heave of the bottom of cut in soft clays. [4]
5. Differentiate between rigid retaining structural and flexible retaining structures in terms of stability and deformation analysis. [4]
6. a) Explain how the bearing capacity of soil is affected by the fluctuation of the water table with neat sketch. [6]
   b) Below figure shows the load-settlement curve obtained from a plate load test conducted on a sandy soil. The size of the plate used was 30cm × 30cm. Determine the size of a square column footing to carry a net load of 3200KN with a maximum settlement of 25mm. [8]

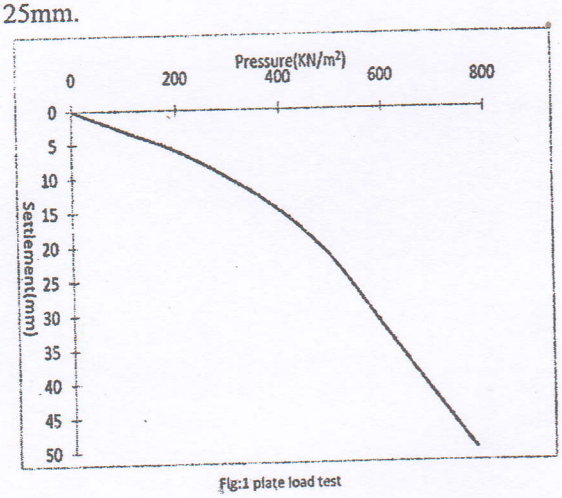

Fig:1 plate load test

7. The 10m × 15m size mat is constructed at 2.5m depth having basement for underground parking. The site consists of highly compressible saturated clay having cohesion of 30 KN/m^2. If the mat carries the total load of 4000 KN. Calculate the factor of safety. [6]

8. a) Elaborate the behavior of single pile differing in its group actions. [4]

   b) A circular pile group of 16 piles penetrates through a unconsolidated soil of 3.5m depth. The diameter of circular pile is 60 cm and pile spacing of 800cm. The average unconfined compressive strength of material is 60 KN/m^2 and the unit weight of soil is 16 KN/m^3. Compute the negative skin friction on the group. Take adhesion factor = 1. [8]

9. Discuss the remedies for tilt and shift of well foundation. Describe with clear sketches the components of well foundations. [3+5]

10. What are the purposes of foundation soil improvement? Explain, in brief, vibroflotation techniques. [2+2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Foundation Engineering *(CE602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. Classify the shallow and deep foundations according to soil conditions. [2]
2. a) Determine the area ratio of a sampler having external radius of 30 mm and wall thickness of 2.25 mm. Do you recommend this sampler for obtaining undisturbed soil samples and why? [2+1]
   b) List the field tests commonly used in subsurface exploration. What are the corrections that must be applied to the SPT-values for sand before they are used in design charts and empirical correlations? [1+4]
   c) What are the things that you will consider while preparing the site investigation repot? [4]
3. a) Explain the relative wall movements and lateral earth pressure coefficients. How do tension cracks influence the distribution of active earth pressure in purely cohesive soils? Distinguish critically between Rankine's and Coulomb's theories of lateral earth pressure. [2+2+2]
   b) A retaining wall of 7.5 m high has two layers of backfill. The soil supported consists of 5m sand ($\gamma = 18KN/m^3$, $\phi = 35°$) overlaying saturated clayey soil ($\gamma = 19.5\ KN/m^3$, $\phi = 35°$, $C = 16KN/m^2$). The ground water table is at the upper surface of the clay. Make a sketch of the distribution of the active pressure on the wall stating the principal values. Calculate the total earth thrust per meter of the wall and its point of application. Assume that the backfill is horizontal at the surface. [10]
4. What is arching effect in soils? A long 5 m wide and 10 m high vertical trench has to be constructed in a deep deposit of cohesive soil with $c = 35\ kN/m^2$ and $\gamma = 18\ kN/m^3$. The safety of the bottom of trench against heave is to be checked before protecting the trench walls using sheet piles. If the excavation to be completed rapidly, determine the factor of safety against bottom heave. What will be the factor of safety if a hard rock is present at 2.5 m from the bottom of the trench? [1+3]
5. What is coffer dam? Describe with neat sketch of the different types of coffer dam. What are the relative merits and demerits of them? [4]
6. a) What are the implications of settlement on structures? Write down the steps of proportioning footings for uniform settlement. [2+4]
   b) A building is to be supported on a reinforced concrete raft covering an area of 14 m × 21 m. The subsoil is clay with an unconfined compressive strength of $14\ kN/m^2$. The pressure on the soil due to weight of the building and loads it will carry will be $135\ kN/m^2$, at the base of the raft. If the unit weight of excavated soil is $19\ kN/m^3$, at what depth should the bottom of the raft be placed to provide a factor of safety of 3? Use Skempton's bearing capacity formula. [6]

7. Write down the concept of compensated foundation. Describe with sketches the various types of mat foundations. [1+5]

8. a) What are the various approaches used to estimate the vertical load bearing capacity of a pile? Write causes and effects of negative skin friction in a pile foundation. [1+4]

   b) A group of 16 piles arranged in a square pattern is to be proportioned in a deposit of soft saturated clay. Assuming the piles to be square with side 30 cm and 12 m long, determine the centre to centre spacing of piles for 100% efficiency of the pile group. Take adhesion factor = 0.8 and consider both point bearing and skin friction. [7]

9. What are the advantages of well foundations over the other types of deep foundations? Explain about the methods use to rectify tilt and shift of the well foundation with clear sketches. [2+6]

10. Write down the different methods of soil improvement techniques. Explain sand compaction piles and stone column. [2+2]

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03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2074 Ashwin

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Foundation Engineering *(CE602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) Classify the foundations according to their soil condition. [2]

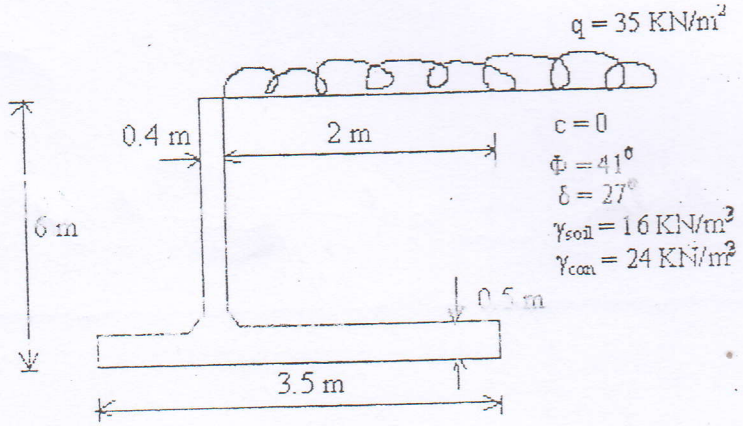
   b) Explain how standard penetration test is carried out in the field. What various corrections are made on the tested value? Describe the nature of sample obtained from the test. [8]

   c) Describe briefly the limitations of plate load test. [4]

   d) Write down the different methods of improving the bearing capacity of weak soils. [4]

2. a) Explain with neat sketch the step by step procedure for Culmann's graphical method of passive earth pressure. [6]

   b) Determine the maximum and minimum pressure under the base of the cantilever retaining wall as shown in figure below and also the factor of safety against sliding and overturning. The approximate shear strength parameters for the soil are c = 0, $\Phi = 41°$. The unit weight of soil and concrete are 16 KN/m^3 and 24 KN/m^3 respectively. The water table is below the base of the wall. Take $\delta = 27°$ on the base of the wall. [10]



3. a) What is the effect of water table on bearing capacity of soil? A footing was designed based on ultimate bearing capacity arrived for the condition of water table at the ground surface. If there is a chance for raise in water level much above the ground level do you expect any change in the bearing capacity, why? [4]

   b) A circular footing is resting on stiff clay with unconfined compression strength of 250 KN/m^2. Determine the diameter of the footing when the depth of foundation is 2 m and the column load is 700 KN assuming a factor of safety as 2.5, the bulk unit weight of sol is 20KN/m^3. What will be the change in ultimate, net ultimate and safe bearing capacity if the water table is at ground level? [8]

4. a) In what respects does the design of flexible retaining structure vary from rigid retaining structure. [3]

   b) A cantilever sheet pile wall is driven into sand deposit having friction angle 35° and bulk unit weight of 22kN/m^3. One side of the sheet pile was backfilled to 3 m height. The backfill material is cohesion less sand having $\Phi = 32°$ and bulk unit weight of 18kN/m^3. Using the simplified method determine the depth if penetration needed for the sheet pile to retain the backfill. Provide a safety factor of 2 for the passive resistance. The water table is below the base of the sheet pile. [5]

5. a) What are the conditions where a pile foundation is more suitable than a shallow foundation? What is a negative skin friction? [3+2]

   b) A group of nine piles, 12 m long and 300 mm in diameter is to be arranged in a square pattern in clay with an average unconfined compressive strength of 75 KN/m^2. Determine the centre to centre spacing of the piles for the efficiency of 1. Neglect the point bearing. [7]

6. a) How do you determine the depth of the well foundation? Describe the process of sinking of well. [4+4]

   b) Describe the procedure of determining the bearing capacity of cohesive cohesion-less soil in case of mat foundation. What is compensated foundations. [4+2]

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06 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2073 Shrawan

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	III / I	Time	3 hrs.

Subject: - Foundation Engineering *(CE602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. a) What is standard penetration test? Write down its procedure. For what purpose can the result of this test be used? How can the standard penetration values be corrected for dilatancy and over burden pressure? [8]

   b) Explain Terzaghi's trap door experiment with neat sketch. A 8 m deep cut in sand with a cut width of 5 m is braced at equal distance of 2 m from the surface at three locations. In the plan the struts are placed at a spacing of 4 m center to center. Using empirical pressure diagram, calculate the design strut loads if the properties of sand is, angle of shearing resistance of 30° and unit weight of 16 kN/m^3. [8]

2. a) High steel sheet pipe wall with smooth vertical back supports a dry cohesionless soil that weighs 18 kN/m^3. The backfill rises from the crest of the wall at an angle of 20° with the horizontal. If the angle of internal friction of backfill materials is 30°, determine the magnitude and point of application of active earth pressure per meter length of the wall. What will be the change in its magnitude and point of application, if water tables rises to an elevation of 2 m below the top of the wall? Take the submerged unit weight of the backfill material as 12kN/m^3. [8]

   b) Describe Culmann's graphical method of finding earth pressure for active state and explain how surcharge will affect earth pressure in active states. [8]

3. a) How do you differentiate whether there will be general or local shear failure at your site? An engineer wants to construct a circular footing of 1 m diameter to transfer the load of 1000 kN with the safety factor of 2.5 to a soil strata with an angle of shearing resistance 30°, cohesion 10kN/m^2 and unit weight of 18 kN/m^3. Suggest the engineer what should be the depth of the footing. Take Terzaghi's bearing capacity factors Nc, Nq and Nγ as 37.2, 22.5 and 19.7 respectively. [4+8]

   b) A mat 18m×22m in plan has its base 3 m below the surface of the deposit of clay with a unit weight of 20 KN/m^3. The unconfined compressive strength of clay is 75 KN/m^2. The factor of safety against bearing capacity failure must be 3. Determine total weight of building plus the foundation the raft can safety support. [4]

4. a) Give a method to determine the bearing capacity of a pile in sandy soil. What is group effect and how will you estimate the capacity of a pile group in sand with neat sketch? Explain the application and limitations of pile load test. [10]

   b) A group of 16 piles of 50 cm diameter is arranged with a center to center spacing of 1.0 m. The piles are 90 m long and are embedded in soft clay with cohesion of 30 kN/m^2. Bearing resistance may be negelected for the piles. Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group. Also check the efficiency of the group of pile. [6]

5. a) What are the conditions that demand the improvement of the soil? Write down the different methods of soil improvement techniques. Write down the measures to be taken for sinking the wells and correcting the tilts and shifts occurred during sinking of caissons. [2+2+4]

   b) Determine the depth of embedment and force in tie rod of an anchored sheet pile wall retaining soil bank of height 5 m. The tie rod is located 1 m below the top of the wall.

03 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2072 Chaitra

Exam.	**Regular**		
Level	BE	**Full Marks**	80
Programme	BCE	**Pass Marks**	32
Year / Part	III / I	**Time**	3 hrs.

Subject: - Foundation Engineering *(CE602)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

1. What are the major criteria to be satisfied in the design of a foundation? [2]
2. a) Differentiate between representative and non-representative soil samples. What are the different sampler design parameters? Explain with their physical meaning (No need to write the formulas) [2+5]
   b) How do you prepare the good site investigation reports? [5]
3. a) What is the earthquake effect on earth pressure? What is the order of horizontal strain required to produce active state in (i) coarse grained soil and (ii) Fine grained soil? What are the tentative dimensions of cantilever retaining walls? [1+2+5]
   b) A retaining wall with a smooth vertical back is 8 m high and retains a 2-layered soil having properties as follows: [8]

Depth (m)	C (KN/m^2)	Φ (degrees)	γ (KN/m^3)
0-4	10	30	18
4-8	0	34	20

   Show the active earth pressure distribution on the back of the retaining wall and its resultant.
4. What are the essential requirements for arching effects? Draw the apparent earth pressure design diagrams recommended by Pecketal (1974) for cuts in sands, firm clay and soft to medium clay. [1+3]
5. What are the different types of cofferdams? What are their relative merits and demerits? [2+2]
6. a) What is the difference among immediate settlements, primary consolidation settlement and secondary compression settlement? Explain the limitations of plate load test. [3+3]
   b) A mat foundation of size 8 m×10 m is resting at a depth of 5 m. The foundation is resting on saturated cohesive soil having undrained cohesion of 50 kPa. The soil has unit weight of 19 KN/m^3. Find the net safe bearing capacity using Skemton's method. [6]
7. What is compensated foundation? Describe the procedure for the conventional design of raft foundations. [2+4]
8. a) Define negative skin friction in pile. Explain a typical situation where negative skin friction may occur. How does negative skin friction affect load carrying capacity of pile? [4]
   b) A pile group consists of 16 piles is driven into a clay deposit. The piles are arranged in square configuration, i.e 4 piles in each direction. The center to center distances between the piles in both directions are 2.4 m. The length of the pile is 10 m and diameter is 0.8 m. The average undrained shear strength along the upper 5 m length of the pile is 40 KN/m^2 and the average undrained shear strength along the lower 5 m length of the pile is 60 KN/m^2. If adhesion factor is 0.6 for both layers, determine the ultimate load capacity of the pile group. [8]
9. Explain with clear sketches the various components of well foundations. What are the different methods to analyze the lateral stability of well foundation? What are the different forces acting on well foundation? [4+2+2]