SHRI ANGALAMMAN COLLEGE OF ENGINEERING AND TECHNOLOGY
(An ISO 9001: 2008 CERTIFIED INSTITUTION)
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DEPARTMENT OF CIVIL ENGINEERING

CE 1306-FOUNDATION ENGINEERING

UNIT – I - SITE INVESTIGATION AND SELECTION OF FOUNDATION

PART – A

1. What is meant by site investigation?
2. What is purpose of site investigation?
3. What are the types of samplers?
4. What is standard penetration test?
5. Define area ratio.
6. Define recovery ratio.
7. What is site reconnaissance?
8. What is significant depth?
9. What is detailed exploration?
10. Define inside and outside clearance of a sampler.
11. List out different methods of sampling techniques.
12. How do you decide the depth of soil exploration?
13. Distinguish between representative and non-representative samples.
14. What are the factors affect the sample disturbance?
15. Describe the split spoon sampler.

PART – B

1. Explain the four methods of site exploration
2. Explain the three important types of soil samplers
3. Explain all types of sampler used to obtain undisturbed samples in clay deposits.
4. Explain the procedure to conduct standard penetration test.
5. What are the corrections to be applied to the observed value of N. give reasons.
6. Write explanatory notes on the following:
   (i)chunk sampling ii) rotary drilling iii) bore hole log iv) electrical resistivity method of ground exploration.
7. Explain different methods of obtaining undisturbed samples in clay layer& sand deposits
8. i) What are the objectives of soil exploration?
   ii) Write notes on seismic refraction method
9. Discuss the selection of foundation based on soil condition.
10. i) What are the causes of disturbance of sample and indicate the remedial measures?

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ii) Write notes on site investigations report.

UNIT – II SHALLOW FOUNDATION

PART – A

1. Write down the components of settlement in soil
2. Define punching shear failure
3. What is net pressure intensity?
4. What is safe bearing capacity?
5. State the types of shear failure in soil mass.
6. Give the equation to determine the elastic settlement of shallow foundation
7. List the factors which affect bearing capacity of soil
8. How would you estimate the settlements of a foundation on cohesion less soils?
9. What are the different types of settlements which can occur in a foundation?
10. Discuss the various methods of determination of the allowable soil pressure.
11. Define bearing capacity of soil
12. Differentiate between the general shear failure and the local shear failure.
13. What are the limitations are used in plate load test.
14. Define gross pressure intensity.
15. Define the net allowable bearing pressure.

PART – B

1. i) Explain the effect of water table on bearing capacity.
   ii) A square footing is located at a depth of 1.3 m below the ground has to carry a safe load of 800 KN. Find the size of the footing. If the factor of safety is 3. The soil has the following properties. Void ratio= 0.55. Degree of saturation = 50 %; specific gravity 2.67. C= 8 KN/m^2, ϕ= 30 ^{o} (Nc=37.2, Nq= 22.5, Nr = 19.7). Use terzaghi's analysis.
2. i) What are the types of settlement? Explain the effect of differential settlement.
   ii) What are the components of settlement in shallow foundation? Explain.
3. i) Write a short notes on the methods of minimizing settlement.
   ii) Plate load tests were conducted in a C-ϕ soil, on plate of two different sizes and the following results were obtained.

	Load	size of plate	settlement
a.	50 KN	0.3 x 0.3 m	25 mm
b.	110 KN	0.6 x 0.6 m	25 mm

4. Find the size of square footing required to carry a load of 1000 KN at the same specified settlement of 25 mm.
5. A footing 2.4 m square carries a gross pressure of 350 KN/m^2 at a depth of 1.2 m in sand. A saturated unit weight of sand is 20 KN/m^3 and the unit weight of sand above water table is 16 KN/m^3. The shear strength Parameters are c'= 0 and ϕ=30^o (for ϕ=30 ^{0}, Nq= 22,

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$N\gamma$=20, Nc =) determine the factor of safety with respect to shear failure for the following cases.

i) Water table is 5 m below the ground level

ii) Water table is 1.2 m below the ground level.

6. Determine the depth at which a circular footing of 3 m diameter be found to provide a factor safety 3, if it has to carry a safe load of 1600 KN, the foundation soil has c = 10 KN/m^2, γ = 18 KN/m^3 . Use terzaghi's analysis.
7. A raft foundation 10 m wide and 12 m long is to be constructed in a clayey soil having shear strength of 12 KN/m^2. Unit weight of soil is 16 KN/m^3. If the ground surface carries a surcharge of 20 KN/m^2. Calculate the maximum depth of foundation to ensure a factor of safety of 1.2 against base failure. Nc for clay is 5.70.
8. Calculate the net ultimate bearing capacity of a rectangular footing 1.8 m x 3.6 m in plan founded at a depth of 1.6 m below ground surface. The load on the footing acts at an angle of 16^o to the vertical and is eccentric in the direction of width by 15 cm the unit weight of the soil is 18 KN/m^3. The rate of loading is slow and hence the effective shear strength can be used in the analysis having c= 15 KN/m^2 and $\phi = 30^o$ natural water table is at a depth of 2 m below the ground surface. Use IS method.
9. Derive terzhaghi's general equation for computing bearing capacity of soils.
10. Explain the plate load test for determining the ultimate bearing capacity of soil.
11. i) What are the assumptions made in the derivation of terzaghi's bearing capacity theory?
    ii) Discuss the effect of water table on the bearing capacity of soil.

UNIT III - FOOTINGS AND RAFTS
PART – A

1. What is a combined footing?
2. Draw the contact pressure distribution below rigid footing.
3. What is spread footing?
4. What is mat foundation?
5. Sketch the pressure distribution beneath a rigid footing on cohesive soil.
6. Under what circumstances mat or raft foundation is used?
7. State the assumptions made in the conventional structural design of footings.
8. Define 'Isobar diagram'.
9. What are the applications of Newark's influence chart?
10. Under what circumstances strap footing is provided?
11. What are the different types of raft foundation?
12. Under what circumstances combined footing is provide.
13. Define the co-efficient of sub grade reaction.
14. How would you fire the depth of foundation?
15. Discuss various types of loads that are to be considered in the design of foundation.

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PART – B

1. i) What are the types of shallow foundations? Give reasons for the selection of the above footings.

   ii) Design a strip footing to carry a load of 750 KN/m at a depth of 1.6 m is a c-ϕ soil having a unit weight of 18 KN/m^3 and shear strength parameters as c= 20 KN/m^2 and ϕ= 25^o. Determine the width of footing using a factor of safety is 3 against shear failure. Use terzaghis equation. Assume for ϕ= 25^o, (Nc= 25.1, Nq= 12.7, Nγ= 9.7).
2. i) Explain the concept of floating foundation.

   ii) What is meant by proportioning of footing? Why it is required.

   iii) Explain the general guide lines for design of mat foundation.
3. i) Find the plan dimensions of a rectangular combined footing to support two columns 250 mm x 250 mm and 300 mm x 300 mm carrying loads of 400 KN and 600 KN respectively. The columns are spaced at 4 m c/c. the allowable bearing capacity of the soil is 200 KN/m^2.

   ii) If one of the column is on the boundary line. Find the dimensions of the combined footing for the above case proportion a strap footing for the following data.

   a. Allowable pressures: 150 KN/m^2 for DL + reduced LL

   a. 225 KN/m^2 for DL + LL

   2. Column loads Column A Column B

      a. DL 500 KN 600 KN

      b. LL 450 KN 800 KN
4. Proportion the footing for uniform pressure under DL + reduced LL. Distance of c/c of column = 5.4 m. projection beyond column should not to exceed 0.5 m.
5. Explain the methods of determining the load carrying capacity of a pile.
6. Explain the various stages involved in the construction of under reamed pile foundation.
7. Explain the design procedure of a combined footing in detail.
8. A trapezoidal footing to be provided to support two square columns of 30cm and 50cm sides respectively. Columns are 6m apart and the safe bearing capacity of the soil is 400KN/m^2. The bigger column carries 5000KN and the smaller column 3000KN. Design suitable size of the footing so that it doesn't extend beyond the faces of the column.

UNIT IV -PILES

PART – A

1. Define negative skin friction in pile
2. How will you find the efficiency of the pile group?
3. Define under reamed pile. In which type of soil such piles are suitable?
4. What are the methods available to determine the load carrying capacity of pile?

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5. On what basis is the allowable load on a pile determined?
6. What are the conditions where a pile foundation is more suitable than a shallow foundation?
7. Describe various dynamic formulae. What are their limitations
8. How would you estimate the group capacity of piles in sand & clay?
9. Define piles. Give the necessity of pile foundations.
10. Define deep foundation.
11. Discuss different methods for the installations of piles.
12. Describe the various types of pile foundation.
13. Describe the necessity of pile foundation
14. What are the classifications of piles?
15. Indicate the circumstances under which pile foundations are used for building construction.

PART – B

1. A square pile group of 16 Piles penetrates through a filled up soil of 3m depth. The pile diameter of 250 mm and Pile spacing is 0.75m. The unit cohesion of the material of soil is 15 KN/m^3. Draw plan and section elevation of the pile group and compute the negative skin friction on the group.
2. Explain with neat sketches the construction of a single under reamed pile.
3. Explain the four common types of uncased cast in-situ concrete pile.
4. A reinforced concrete pile weighing 30 KN is driven by a drop hammer weighing 40 KN and having an effective fall of 0.8 m. the average set per blow is 1.4 cm. the total temporary elastic compression is 1.80 cm. assuming the co-efficient of restitution as 0.25 and a factor of safety 2. Determine the ultimate bearing capacity and the allowable load for the pile.
5. Design a friction pile group to carry a load of 3000 KN including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20m, underlain by rock. Average unconfined compressive strength of the clay is 70 KN/m^2. The clay may be assumed to be of normal sensitivity and normally loaded, with liquid limit of 60 %. A factor of safety is 3. Required against shear failure.
6. i) Explain hilley's formula for determining load carrying capacity of piles. Give comments about using dynamic formulae.

   ii) A Pile group of 9 Piles arranged in a square pattern with diameter and length of each pile has 25 cm and 10 cm respectively is used as a foundation in soft clay deposit. Taking the unconfined compressive strength of clay as 120 KN/m^2 and pile spacing as 100 cm c/c, find the load carrying capacity of the group. Assume the bearing capacity factor Nc = 9 and adhesion factor = 0.75, Assume a factor of safety is 2.5
7. Determine the load carrying capacity of a single pile of diameter 0.5 m and embedded length of 10 m in a clay deposit having c= 25 KN/m^2 what will be the change in load

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carrying capacity . if the same pile has been constructed with bulbs at 2 m, 6m and 9 m as an under reamed Pile. Assume factor of safety is 3. For both conditions.

8. i) Discuss the uses of penetration tests for the estimation of load- carrying capacity of piles.
   ii) Discuss the method for the design of a) Tension piles b) Inclined piles.
9. Explain the pile driven procedure.
10. Explain the settlement of pile groups.

UNIT V - RETAINING WALLS
PART – A

1. What is surcharge?
2. What is failure wedge?
3. How do you check the stability of retaining wall?
4. Distinguish Rankine's theory from coulomb's wedge theory
5. What is earth pressure at rest?
6. State the assumptions in Rankine's earth pressure theory.
7. Compare gravity retaining wall with cantilever retaining wall with reference to resistance of lateral earth pressure
8. What do you meant by critical height of unsupported cuts in clay soils?
9. Write down the assumptions made in the coulomb's theory.
10. What are the different types of lateral earth pressure?
11. Compare Rankine's theory and coulomb's theory.
12. Write down the assumptions made in the Rankine's theory.
13. What is mean by trial wedge method?
14. What are the different types of sheet pile walls
15. Discuss various methods for providing anchors for a sheet pile walls.

PART – B

1. i) Explain active state and passive state of plastic equilibrium in soils.
   ii) A retaining wall of 8 m high has a smooth vertical back. The back fill has a horizontal surface. There is a uniform distributed surcharge load of 2.4 KN/m^2 intensity over the backfill. Determine the magnitude and point of application of active pressure per meter length of the wall. Assume c= 0 ϕ= 30 ^{o} and γ= 18 KN/m^3
2. i) Explain Rebhann method of graphical solutions for active pressure on retaining walls.
   ii) Explain the criteria of design of gravity retaining wall.
3. i) Explain with a neat sketch the Culmann's method of calculating active earth pressure.
   ii) A retaining wall 6 m high retains sand with ϕ=30 ^{o} and unit weight 24 KN/m^3 upto a depth of 3 m from top. From 3 m to 6m, the material is a cohesive soil with C= 20 KN/ m^2 and

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$\phi=20^o$. Unit weight of cohesive soil is 18 KN/m^3.A uniform surcharge of 100 KN/m^3 is acting on the top of the soil. Determine the total lateral pressure acting on the wall and its point of application.

4. Explain the Rankine's theory for passive earth pressure for the cases of cohesion less back fill and cohesive back fill.
5. Explain the coulomb's wedge theory of earth pressure with a neat sketch.
6. A retaining wall 6m high, vertical back, supports a saturated clay soil with a horizontal surface. The properties of the backfill are:
7. Qu = 0, Cu = 35 KN/m^2, γ = 17 KN/m^3. Assuming the back of the wall to be smooth,
8. Determine the following:
    i) The depth of tension cracks.
    ii) The critical depth of a vertical cut.
    iii) The total active thrust against the wall and its point of application, if cracks are formed in the tension zone.
9. Derive an expression for RanKine's active earth pressure on retaining walls due to a cohesion backfill.
10. Explain Rankine's theory of active earth pressure for a submerged backfill.

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