MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Department of Civil Engineering
Question Bank - Academic Year (2021-22)

Course Code & Course Name : 19CEE12 & Foundation Engineering

Year/Sem/Sec : III/V/-

Unit-I : Site Investigation and Selection of Foundation

Part-A (2 Marks)

1. What is significant depth?
2. What is detailed exploration?
3. Define: (a) Area ratio (b) Inside clearance of sampler
4. List out different methods of sampling techniques.
5. A SPT is conducted in fine sand below water table and a value of 27 is obtained for N. what is the corrected value of N?
6. What is bore log?
7. One sampler has an area ratio of 10% while another has 18%, which of those samples do you prefer and why?
8. Define recovery ratio and how it is useful in judging the nature of soil.
9. What are the methods of site exploration?
10. List out the various boring methods.
11. List any two objectives of foundation.
12. Under what circumstances friction piles are adopted?
13. How do you decide the depth of soil exploration?
14. Distinguish between representative and non-representative samples?
15. Write any two purposes of site investigation.
16. What is the first step of sub-surface exploration programme?
17. Write any two types of boring.
18. Name the most commonly used in-situ test for cohesion less soil.

Part-B (16 Marks)

1. Explain different methods of obtaining undisturbed samples in (i). clay layer and (ii). Sand deposits (16)
2. Explain the electrical resistivity method in detail. (16)
3. Write explanatory notes on the following (16)

a. Chunk sampling
b. Rotary drilling
c. Bore hole log
d. Electrical resistivity method of ground exploration.

4. Explain with neat sketches any three type of samplers. (16)

5.(i). Write short notes on block or chunk sampling. (8)

(ii). How do you select suitable foundation based on soil conditions? (8)

6. Briefly explain standard penetration test and the corrections to be applied to find N value. (16)

7.(i). What are the objectives of soil exploration? (8)

(ii). Write down the procedure to conduct standard penetration test. (8)

8. Discuss the selection of foundation based on soil condition. (16)

9. Explain different types of borings for soil exploration. (16)

Unit-II : Shallow Foundation

Part-A (2 Marks)

1. What is spread footing?
2. Sketch the pressure distribution beneath a rigid footing on cohesive soil.
3. What is safe bearing capacity?
4. Write down the components of settlement.
5. Define punching shear failure.
6. Define settlement and list its components.
7. What are the conditions to be followed for locating the foundations in a sloping ground?
8. Write the various factors affecting the bearing capacity of soil?
9. Write any two limitations of plate load test
10. What is meant by safe bearing pressure?
11. Write SBC equation for strip footing as per Terzaghi's analysis.
12. What is meant by immediate settlement?
13. What are the types of shallow foundation?
14. List the factors which affect bearing capacity of soil?
15. Write down the components of settlement in soil?
16. Define allowable bearing pressure.
17. What is the principle of Rankine's analysis?
18. What is the assumption of Terzaghi related to base of the footing?
19. As per Terzaghi, which equation governs the shear strength of soil?

Part-B (16 Marks)

1. Explain the Terzaghi's analysis for determining the safe bearing capacity of the soil. (16)

2. Explain the plate load test for determining the ultimate bearing capacity of the soil. (16)

3. Calculate the net ultimate bearing capacity of a rectangular footing 1.8m x 3.6m in plan founded at a depth of 1.6m below ground surface. The load on the footing acts at an angle of 16° to the vertical and is eccentric in the direction of width by 15cm. the unit weight of the soil is 18kN/m^3. The rate of loading is slow and hence the effective shear strength can be in the analysis, having c' = 15kN/m^2 and Φ =30°. Natural water table is at a depth of 2m below the ground surface. Use IS method. (16)

4. Derive Terzhaghi's general equation for computing bearing capacity of soils. (16)

5.(i). Explain the various causes of settlement and how to minimize it. (8)

(ii). Compare general shear failure with shear failure. (8)

6. The footing of a column is 2.25m square and is founded at a depth of 1m on a cohesive soil of unit weight 17.5kN/m^3 angle of internal friction is zero and factor of safety is 3. Terzaghi's factors for $\varphi = 0$ are $N_c = 5.,7$ $N_q = 1$, $N_r = 0$ (16)

7. A square footing 1.2m x 1.2m rests at a depth of 1m in a saturated clay layer 4m deep. The clay is normally consolidated, having an unconfined compressive strength of 40N/m^2, the soil has a LL of 30%, r_{sat} = 17.8 kN/m^3, w = 28% & G = 2.68. Determine the load which the footing can carry safety with a factor of safety of 3 against shear. Also, determine the settlement if the footing is loaded with this safe load. Use Terzaghi's analysis for bearing capacity. (16)

8. A square man concrete footing supporting a load of 3250kN extends form ground level to 3.5m deep into a clay structure. What will be the size of the footing allowing for a factor of safety of 4.0? unit weight of concrete 25kN/m^3. Shear strength of soil 0.12N/mm^2. Adhesion of clay with footing is 25kN/m^3. The adhesion may be supported to act over a depth of 12 from the bottom of the foundation. For $\varphi = 0°$, the values of N_c=2.7, N_q=1, N_r=0. (16)

9.(i). Write a short note on the method of minimizing settlement. (8)

(ii). Plate load tests were conducted in a C Soil, on plate of two different sizes and the following results were obtained (8)

LOAD	SIZE OFPLATE	SETTLEMENT
50KN	0.3X0.3m	25mm
110KN	0.6x0.6m	25mm

Find the size of square footing required to carry a load of 1000KN at the same specified settlement of 25mm.

10. Determine the ultimate bearing capacity of a strip footing, 1.2m wide and having the (16)

depth of foundation of 1m. Use Terzaghi theory and assume general shear failure. Take Φ=35˚

Unit-III : Footings And Rafts

Part-A (2 Marks)

1. What is gross pressure intensity?
2. Under what circumstances mat or raft foundation is used?
3. State the assumptions made in the conventional structural design of footings.
4. Define combined footing and in what situation it is preferred?
5. Write any two advantages of the floating foundation.
6. State the reason why higher settlement is permissible in clay than in sand.
7. What do you understand by truly elastic foundation?
8. How immediate settlement can be expressed based on theory of elasticity?
9. Under what circumstances strap footing is adopted?
10. What is meant by floating foundation?
11. Under what circumstances strap footing is provided?
12. Draw the contact pressure distribution below rigid footing.
13. Classify Foundation Settlement under loads.
14. What is the reason for structural collapse of soil?
15. Based on which theory consolidation settlement in clays is calculated?
16. Why foundation settlement prediction is not accurate often?

Part-B (16 Marks)

1. Explain the design procedure of a rectangular footing in detail. (16)
2. Explain the design procedure of a combined footing in detail. (16)
3. Proportion a strap footing for the following data: (16)

   Allowable pressure : 150 kN/m^2 for DL + reduced LL

   225 kN/m^2 for Dl + LL

Column loads:		Column A	column B
Dl	-	500 kN	600 kN
LL	-	450 kN	800 kN

   Proportion the footing uniform pressure under DL + reduced LL. Distance c/c column 5.4m. Projection beyond column a not to exceed 0.5m.

4. A trapezoidal footing to be provided to support two square columns of 30cm and 50 cm sides respectively. Columns are 6m apart and the safe bearing capacity of soil is 400kN/m^2. The bigger column carries 5000kN and the smaller column 3000kN. Design suitable size of the footing so that it does not extend beyond the faces of the column. (16)

5. A building is to be supported on a R.C.C raft foundation of dimensions 12m x 18m. The subsoil is clay which has an average unconfined compressive strength of 15 kN/m^2. The pressure on the soil due to the weight of the building and the loads it will carry is expected to be $130kN/m^3$ at the base of the raft. If the unit weight of the excavated soil is $18kN/m^3$, determine the depth at which the bottom of the raft should be placed to provided a factor of safety of 3 against shear failure. (16)

6.(i). Find the plan dimension of a rectangular combined footing to support two columns 250x250mm and 300x300mm carrying loads of 400KN and 600KN respectively. The columns are spaced at 4mc/c. The allowable bearing capacity of the soil is $200KN/m^2$. (8)

(ii). If one of the column is on the boundary line. Find the dimensions of the combined footing for the above case. (8)

7. A footing 2.4m square carries a gross pressure of 350KN/m2 at a depth of 1.20m in sand. A saturated unit weight of sand is 20KN/m3 and the unit weight of sand above water table is 16kn/m3. The shear strength parameters are $C' = 0$ and $\Phi' = 30°$ (for $\Phi' = 30°$ $N_q = 22$, $N_\gamma = 20$). Determine the factor of safety with respect to shear failure for the following cases: (16)

   (i) W.T. is 5m below the ground level

   (ii) W.T. is 1.2m below the ground level.

8. Describe the step by step procedure for the design of a combined footing. (16)

Unit-IV : Pile Foundation

Part-A (2 Marks)

1. What is friction pile?
2. On what basis, is the allowable load on a pile determined?
3. Define negative skin friction in pile.
4. How will you find the efficient of the pile group?
5. Define feld's rule
6. What is test pile?
7. Define fender piles.
8. What is negative skin friction?
9. What is meant by negative skin friction?
10. What is the need of pressure piles?
11. State any two functions of piles foundation.
12. Define pile cap.
13. Define negative skin friction?
14. What are the methods available to determine the load carrying capacity of pile?
15. What is the main condition for the usage of piles?

16. Classify piles according to materials.
17. What do you mean by sheet pile?
18. What are the in-situ penetration tests for pile capacity?

Part-B (16 Marks)

1. A reinforced concrete pile weighing 30 kN (including of helmet and dolly) is driven by a drop hammer weighing 40kN and having an effective fall of 0.80m. the average set per blow is 1.40cm. The total temporary elastic compression is 1.80cm. Assuming the coefficient of restitution as 0.25 and a factor of safety of 2. Determine the ultimate bearing capacity and allowable load for the pile. (16)
2. Design a friction pile group to carry a load of 3000kN 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 70kN/m^2. The clay may be assumed to be normal sensitivity and normal loaded, with liquid limit of 60%. A factor of safety of 3 is required against shear failure. (16)
3. A square pile group of 16 pile penetrates through a filled up soil 3m depth. The pile diameter of 250mm and pile spacing is 0.75m. the unit cohesion of the material is 18kN/m^2 and the unit weight of soil is 15kN/m^3. Draw plan and section elevation of the pile group and compute the negative skin friction on the group. (16)
4. Explain with neat sketches the construction of a single under reamed pile. (16)
5. A group of 16 piles of 50 cm diameter is arranged with a centre to centre spacing of 1m. the piles are 10m long and are embedded in soft clay with cohesion of 30kN/m^2. Take m = 0.6 for shear mobilization around each pile. Determine the ultimate load capacity of the pile group neglecting the bearing resistance. (16)
6. How the piles are classified? Explain them in details. (16)
7. Describe the method of conducting a pile load test. (16)
8. Design a friction piles group to carry a load of 3000kN including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20, underlain by rock. Average unconfined compressive strength of the clay is 70 kN/m^3. The clay may be assumed to be normal sensitivity and normaly loaded, with liquid limit 60%. A factor of safety of 3 is required against shear failure. (16)
9. A 200mm diameter, 8m long piles are used as foundation for a column in a uniform deposit of medium clay (unconfined compressive strength = 100 kN/m^3 and adhesion factor = 0.9). There are nine arranged in a square pattern of 3 x 3. For a group efficiency = 10, find the spacing between the piles (neglect bearing). (16)
10. A reinforced concrete pile weighing 40KN is driven by a drop hammer weighing 40KN and having an effective fall of 0.8m.the average set per blow is 1.4cm. the total (16)

temporary elastic compression is 1.8cm. Assuming the coefficient of restitution as 0.25 and a factor of safty 2. Determine the ultimate bearing capacity and allowable load for the pile.

11.(i) Explain the factors governing the efficiency of group piles. (8)

(ii) Write short notes on (i) Forces acting on pile cap. (ii) Under reamed pile construction. (8)

12. A concrete pile, 300mm dia is driven in to a medium dense sand ($\Phi = 35^\circ$ £ = 21kN/m³ K =1 tan $\zeta = 0.7$) for a depth of 8m. Estimate the safe load. Take F O S = 2.5 (16)

13. Explain the concept of relative skin friction and under reamed piles. (16)

Unit-V : Retaining Walls

Part-A (2 Marks)

1. What is surcharge?
2. What is failure wedge?
3. What do you meant by critical height of unsupported cuts in clay soils?
4. Write down the assumptions made in the coulomb's theory**.**
5. Define surcharge angle.
6. Write the assumption in Rankine's earth pressure theory.
7. Define coefficient of earth pressure at rest.
8. Define passive earth pressure.
9. What is meant by surcharge?
10. What is meant by plastic equilibrium?
11. What is meant active earth pressure?
12. What is co-efficient of earth pressure?
13. How do you check the stability of retaining wall?
14. Distinguish Rankine's theory from coulomb's wedge theory.
15. Up to what height cantilever Retaining wall is found to be economical?
16. What is the range of factor of safety for no overturning to occur for the retaining wall?
17. For Which soil Rankine's Original theory was formulated?
18. What are the assumptions of Coulomb's wedge theory related to backfill?

Part-B (16 Marks)

1. Explain the coulomb's wedge theory in detail. (16)

2. Explain Rankine's theory of active earth pressure for a submerged backfill. (16)

3. A retaining wall 6m high, vertical back, supports a saturated clay soil with a horizontal surface. The properties of the backfill are: $C_u = 0$, $C_u = 35$ kN/m^{2,} $\gamma = 17$ kN/m^3 Assuming the back of the wall to be smooth, determine (16)

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.

4. Drive the expression for Rankine's active earth pressure on retaining walls due to a cohesion backfill. (16)

5. A smooth backed vertical wall is 4m height and retains a soil with a bulk unit weight of 18kN/m^3 and φ = 30. The top of the soil is level with the top of the wall and is horizontal. If the soil surface caries a uniformly distributed load of 36 kN/m^2. Determine the total active thrust per meter length of the wall and its point of application. (16)

6. A retaining wall, 4m high supports a backfill (c =20 kN/m^2; φ = 30°; γ = 20 kN/m^3) with horizontal top, flush with the top of the wall. The backfill carries a surcharge of 20 kN/m^2. If the wall is pushed towards the backfill, compute the total passive pressure on the wall and its point of application. (16)

7. A retaining wall has smooth vertical back. The backfill has a horizontal surface in level with the top of the wall. There is uniformly distributed surcharge load 36kN/m^2 intensity over the backfill. The unit weight of the backfill is 18 kN/m^3; its angle of shearing resistance is 30° and cohesion is zero. Determine the magnitude and point of application of active pressure per meter length of the wall. (16)

8. Explain with a neat sketch the culmann's method of calculating active earth pressure. (16)

9. A retaining wall 6m high retains sand with Φ=30° and unit weight 24KN/m^3 up to a depth of from top. From 3m to 6m, the material is a cohesive soil with c= 20 KN/m^2 and Φ=20°. Unit weight of cohesive soil is 18 KN/m^3. A uniform surcharge of 100KN/m^2 is acting on the top of the soil. Determine the total lateral pressure acting on the wall and its point of application. (16)

10. Describe the principles of design of Retaining walls. (16)

Course Faculty **HoD**