QUESTION BANK

SITE INVESTIGATION AND SELECTION OF FOUNDATION

PART A

1. List the various methods of soil exploration techniques.
2. What is the scope of soil investigation?
3. What is the objective of soil investigation?
4. List the merits and demerits of wash boring.
5. What are various methods of site exploration?
6. Write short notes on Augur boring.
7. Define standard penetration number.
8. List the various corrections to be carried out in SPT test.
9. What are the uses of soil exploration?
10. What is soil exploration?
11. List the different types of samplers.
12. List the various parameters affecting the sampling disturbance.
13. Write the advantages of SCPT over SPT.
14. Write short notes on spacing of bore holes.
15. Explain disturbed & un-disturbed samples.
16. Distinguish between representative and non-representative samples.
17. Define liquefaction of sand?
18. Define area ratio?

PART B

1. Write a detailed note on various samplers.
2. Explain static cone penetration test in detail.
3. Write a detailed on various types of boring.
4. Write a detailed on various types of samplers.
5. Explain SPT test and plate load test in detail.
6. Explain the various parameters which affect the sampling in detail.
7. Explain the Geophysical methods.
8. Discuss selection of foundation based on soil condition.
9. Explain dynamic cone penetration test
10. Describe the salient features of a good sub-soil investigation report?

SHALLOW FOUNDATION

Part A

1. What is shallow foundation?
2. What are the factors to be considered while designing the foundation?
3. Define Bearing capacity and Ultimate bearing capacity.
4. Define Net ultimate bearing capacity and Net safe bearing capacity.
5. Define Safe bearing capacity and Allowable bearing pressure.
6. Explain ultimate bearing capacity with the help of load settlement curve.
7. State the different modes of shear failure.
8. In what way the local shear failure differs from General shear failure.
9. How the effective dimensions can be calculated in an eccentrically loaded footing?
10. What are the Assumptions made in Terzaghi's Analysis?
11. State the Limitations of Terzaghi's Analysis.
12. State the factors affecting Bearing capacity.
13. What is the correlation between C.P.T. and S.P.T. values?
14. Define Settlement.
15. What are components of settlement?
16. Define Co-efficient of settlement.
17. Define Immediate Settlement (Si).
18. Define primary consolidation.
19. Define Secondary compression settlement.
20. Define seat of settlement.
21. State the corrections to be made for the Settlement due to Consolidation.
22. State the corrections made for the observed SPT values.
23. State the factors affecting Bearing capacity.
24. State Permissible Settlement as per IS code.
25. State the seismic considerations in shallow foundation.

Part B

1. What are the IS code recommendations for the location and depth of foundation?
2. Explain the different modes of failure of foundation soil.
3. Explain the procedures for the SPT, SCPT and Plate load test.

4. What is settlement? What are the components of settlement? Distinguish between them?
5. Calculate the Safe bearing capacity per unit area of

   (1) a strip footing 1 m wide

   (2) a square footing 3m x 3m, and

   (3) a circular footing of 3m diameter.

   (4) a rectangular footing of 1.3x2.2m

   Unit weight of the soil 1.8 t/m^3, cohesion = 2t/m^2 And $\Phi = 20^o$,$N_c = 17.5$, $N_q = 7.5$ and N $\gamma = 5$. Depth of footing is 1.6m below ground surface.

6. A strip footing 2 m wide carries a load intensity of 400 KN/m^2 at a depth of 1.2 m in sand. The saturated unit weight of sand is 19.5kN/m^3 and unit weight above water table is16.8KN/m3. The shear strength parameters are c = 0 and $\Phi = 35^o$. Determine the factor of safety with respect to shear failure for the following cases of location of water table. Determine the ultimate bearing capacity of the footing , if the ground water table is located
   (a) at a depth of 0.5 m below the ground surface,
   (b) at a depth of 0.5m below the base of the footing.
   (c) at the base of footing
   (d) at the ground level
   .
   Use Terzaghi theory.

7. An R.C. Column footing 2.26 m in square shape is to rest 1.5 m below level ground level is on cohesive soil. The unit weight is 17.6kN/m^3. What is the safe load if cohesion is 30 kN/m^3 factor of safety 2.4. Angle of internal friction 33° and value of N_c= 30.4 N_γ = 33 and N_q = 32.
8. Design a strip footing to carry a load of 750 kN/m at a depth of 1.6m in a cohesive soil having unit weight of 18kN/ m^3 & c=20kN/m^2 and angle of internal friction is 25 degree. Determine the width of footing, using F.O.S as 3. Use terzhagi's equations. N_c = 25.1, N_q = 12.7 and N $_\gamma$ = 9.7

9. In a plate bearing test on pure clayey soil failure occurred at a load of 12.2 tones. The size of the plate was 45 cm x 45 cm and the test was one at a depth of 1.0 m below ground level. Find out the ultimate bearing capacity for a 1.5 m wide continuous wall footing with its base at a depth of 2m below ground level. The unit wt. of clay may be taken as 1.9 gm/ c.c. and $N_c = 5.7$, $N_q = 1$ and $N_\gamma = 0$.
10. A square footing located at a depth of 1.5 m below the ground surface in cohesionless soil carries a column load of 1280 kN. The soil is submerged having an effective unit weight of 11.5kN/m^3 and an angle of shearing resistance of 30°. Find the size of the following for Fs = 3 by Terzaghi's theory of general shear failure,
11. A footing foundation of 3m X 3m is to be constructed at a site at a depth of 1.5 m below ground level. The water table is at the base level of foundation. The average static cone penetration resistance obtained at the site is 20 Kg/m^2. The soil is cohesive determine the safe bearing capacity for a settlement of 40mm.
12. Two plate load test s were conducted at the level of a prototype foundation in cohesionless soil close to each other. The following data are given.

Size of plate	Load applied	Settlement recorded
0.3m X 0.3m	30 KN	25 mm
0.6m X0.6m	90 KN	25 mm

If the footing is to carry a load of 100KN, determine the size of the footing for the same settlement of 25 mm.

13. A rectangular footing of 2.5 X3.5 m is at a depth of 1.5m having the following soil parameters. The shear strength parameters are c = 20kN/ m^2. And Φ = 20° . Determine the safe bearing capacity. The load is acting 15 degree to the vertical and 30cm eccentric along the width. Use IS 6403 recommendations. Assume any data missing.
14. A square footing of 2.5 X2.5 m is at a depth of 1.5m having the following soil parameters. The shear strength parameters are c = 0 and Φ = 35° . Determine the safe bearing capacity. The load is acting 28 degree to the vertical and 20mm eccentric along the width. Use IS 6403 recommendations. Assume any data missing.
15. A footing with size of 1.8x3m has to transmit load of a column at a depth of 1.5m. Calculate the safe load with FOS=3, & soil has following properties. Porosity = 10%, sp.gra= 2.67,C= 8kN/ m^2. Φ = 35°. Use IS equation.

PILE FOUNDATION

Part A

1. Where the deep foundations are employed?
2. What are the General forms of deep foundation?
3. What are the different types of piles according to Material of construction?
4. Draw the failure pattern of pile foundation.
5. What are the different types of piles according to its function?
6. What are the different types of piles according to its method of Installation?
7. What are the different types of piles according to its Shape?
8. Draw the various patterns of pile arrangements.
9. State the methods of pile driving.
10. State the Types of piles with patent rights
11. Define cased pile and uncased (or) shell – less pile.
12. Explain the Protection of pile during driving
13. What are the precautions should be to ovoid heaving of soil while driving the pile?
14. What are the methods for estimating the load –carrying capacity of a single pile?
15. Define Pile load test.
16. What are the Reasons for conducting initial tests on piles?
17. What are the preparations should be made for pile load test?
18. Define Negative skin friction (or) down drag.
19. Define Group action of piles.
20. Give the importance of spacing of piles in group action.
21. Give the minimum spacing of piles.
22. State the procedure for driving the piles as a group.
23. Define Pile group efficiency.
24. What are the factors affecting group efficiency?
25. What are the reasons for the settlement of pile groups?
26. State the seismic considerations in pile foundation.

Part B

1. Explain the method of Hammer driving.
2. Explain the method of vibration driving and jetting?
3. What are the effects of Effects of pile driving?
4. Explain the Static method for Estimating the load carrying capacity of a single pile driven in cohesion less soil (Sand).
5. Explain the Static method for Estimating the load carrying capacity of a single pile driven in cohesive soil (Clay).
6. Explain the in- situ penetration tests for Estimating the load carrying capacity of a single driven pile.
7. Explain the Dynamic formulae for Estimating the load carrying capacity of a single driven pile.
8. Explain Vertical load test on piles (compression).
9. Explain Vertical cyclic loading test (compression).
10. Explain how the Group capacity can be found by different methods.
11. How the settlement of a group of piles can be determined.
12. A concrete pile 30 cm diameter is driven into a medium dense sand ($\varphi = 35°$, γ =21 kN/m^3), k = 1.0, tan δ = 0.7, Nq = 60). For a depth of 8m. estimate the safe load, taking a factor of safety of 2.5, if the water table rises to 2 m below the ground surface take γ_w = 10 kN/m^2.
13. A 30 cm diameter concrete pile is driven into a homogenous consolidated day deposit (C = 40kN/m^2 , α = 0.7) if the embedded length is 10m, estimate the safe load. (F.S = 2.5)
14. A square concrete pile (30cm side) 10 m long is driven into coarse sand having γ = 18.5 kN/m^3 & N = 20. Determine the allowable load (F.S = 3.0).
15. A precast concrete pile is driven by a single acting steam hammer. Estimate the allowable load using
    a. ENR formula (F.S = 6)
    b. Hiley formula
    c. Danish formula
16. A pile group consists of 9 friction piles of 30cm diameter and 10m length driven in clay (Cu = 100kN/m2. γ = 20kN/m^3) as shown in the figure. Determine the safe load for the group (F.S =3, α = 0.6).

17. Design a square pile group to carry 400 kN in clay with an unconfined compressive strength of 60 kN/m^2. the piles are 30 cm diameter and 6 m long. Adhesion may be taken as 0.6 .
18. A 16 pile group has to be arranged in the form of a square in soft clay with uniform spacing. Neglecting end bearing, determine the optimum value of the spacing of the piles in terms of the pile assuming a shear mobilization factor of 0.6 .

RETAINING WALLS

Part A

1. Define Active Earth pressure.
2. Define Passive Earth pressure.
3. Define coefficient of earth pressure.
4. Enumerate the assumptions made in Rankine's theory.
5. What is the critical height of an unsupported vertical cut in cohesive soil?
6. Enumerate the assumptions made in Coulomb's Wedge theory.
7. Give the criteria for the design of gravity retaining wall.
8. Distinguish Coloumb's wedge theory from Rankine's theory?
9. Write down any two assumptions of Rankine's theory?
10. Sketch the variation of earth pressure and coefficient of earth pressure with the movement of the wall.
11. What are the stability conditions should be checked for the retaining wall?
12. Give the minimum factor of safety for the stability of a retaining wall.
13. Draw the various Drainage provisions in Retaining wall.
14. If a retaining wall of 5 m high is restrained from yielding, what will be the total earth pressure at rest per metre length of wall? Given: the back fill is cohesion less soil having $\varphi = 30°$ and $\gamma = 18$ kN/m^3.
15. Draw the lateral earth pressure diagram of clay depend for active condition.
16. Make an estimate of lateral earth pressure coefficient on a basement wall supports soil to a depth of 2 m. Unit weight and angle of shearing resistance of retained soil are 16 kN/m^3 and 32° respectively.

Part B

1. A retaining wall is 4 metres high. Its back is vertical and it has got sandy backfill up to its top. The top of the fill is horizontal and carries a uniform surcharge of 85 kN/m^2. 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/m^3. 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.
2. Explain Rankine's Active earth pressure theory for cohesion less soil.
3. Explain Rankine's Active earth pressure theory for cohesive soil.
4. Explain Rankine's Passive earth pressure theory for cohesion less and cohesive soil.
5. Explain coulomb's wedge theory.
6. Explain Culmann's construction for active pressure of cohesion less soil.
7. Explain the Effect of line load on retaining wall.
8. A cantilever retaining wall of 7 metre height retains sand. The properties of the sand are γ_d = 17.66 kN/m^3 and γ sat = 29.92 KN/m^3, φ = 30°. Using Rankine's theory determine active earth pressure at the base when the backfill is (i) Dry, (ii) Saturated and (iii) Submerged. A rigid retaining wall of 6 m high, has a saturated backfill of soft clay soil. The properties of the clay soil are γ_{sat} = 17.56 kN/m^3, unit cohesion Cu = 18 kN/m^2. Determine the expected depth of tensile crack in the soil.
9. A retaining wall of 6 m high has a saturated backfill of soft clay soil. The properties of the clay soil are γ_{sat} = 17.56 kN/m^3, unit cohesion Cu = 18 kN/m^2. Determine (a) the expected depth of tensile crack in the soil (b) the active earth pressure before the occurrence of tensile crack, and (c) the active pressure after the occurrence of tensile crack.