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## Department of Civil Engineering

### *Question Bank*

**Subject – BTCVC602_Foundation Engineering**

**Module 1: Introduction and soil exploration**

1. List out the different primary objectives of soil exploration.
2. Enlist different soil exploration methods and explain any one in detail.
3. Explain Geophysical exploration method to determine the Soil properties.
4. State different types of samples and explain uses of each type.
5. Explain the general requirements to be satisfied for satisfactory performance of foundation.
6. What is sample, sampler and sampling, what is inside clearance and outside clearance? Why it is required for the sampler?
7. Two sampler A and B are available at site which sampler do you use and why. Details of samplers A and B are as follows

| Sampler | Cutting edge dimension (mm) | | Sampling tube dimension (mm) | |
|---|---|---|---|---|
| | External Diameter | Thickness | External diameter | Thickness |
| A | 77 | 2.5 | 75 | 1.5 |
| B | 112 | 2.75 | 110 | 1.7 |

8. Enlist the methods of collecting rock samples. Explain any one in detail.
9. Write a short note on a) Core Barrels b) core boxes c) core recovery
10. State different types of soil samplers and explain uses of each type.
11. Explain inside clearance, outside clearance and area ratio of the sampler.
12. State advantages and disadvantages of Boring methods.
13. Explain electrical resistivity method in detail with neat sketch.
14. Explain seismic refraction method of soil exploration with neat sketch. A sampling tube has inner diameter of 70mm and cutting edge of 68mm. its outside diameters are 72 mm and 74 mm respectively. Determine area ratio, inside clearance, outside clearance of the sampler.
15. Explain the thin walled sampler with neat sketch. Also discuss the soil strata in which thin walled sampler are used.

**Module 2: Bearing Capacity Analysis**

1. A strip footing of width 3 m is founded at a depth of 2 m below the ground surface in a (c – Ø) soil having a cohesion c = 30 kN/m2 and angle of shearing resistance Ø = 35°. The water table is at a depth of 5 m below ground level. The moist weight of soil above the water table is 17.25 kN/m3. Determine:
   (a) The find ultimate bearing capacity of the soil.
   (b) The net bearing capacity.
   (c) The net allowable bearing pressure and the load/m for a factor of safety of 3.
2. Use the general shear failure theory of Terzaghi.
3. Explain the design criterion of foundation in settlement.
4. Explain the IS code method for bearing capacity evaluation.
5. State and explain different types of bearing capacities.
6. Explain Terzaghi's Bearing capacity theory in detail with neat sketch.
7. Explain the effect of water table on bearing capacity of soil.
8. Explain Meyerhof's Bearing capacity analysis in detail with neat sketch.
9. A strip footing, 1.5 m wide, rests on the surface of a dry cohesionless soil having $\phi$ =20o and $\gamma$ = 19kN/m3 . If the water table rises temporarily to the surface due to flooding, calculate the percent reduction in ultimate bearing capacity of the soil. Assume $N\gamma = 5.0$
10. Calculate safe bearing capacity for a square footing of width 2.0m placed at a depth of 2m in a soil having r = 19kN/m3, c = 20kN/m2 and $\varphi$ = 300 Assume soil fail by general shear, water table is at large depth Use IS code method. For $\varphi$ = 300 IS code bearing capacity factors are Nc =30.14 Nq =18.4 and Nr =22.4
11. Design a rectangular footing with L/B ratio = 1.25 to carry safe load of 1000kN. Footing is to be placed at a depth of 2m in a soil r = 19kN/m3, c = 20kN/m2 and $\varphi$ = 350 Assume soil fail by general shear, water table is at large depth Use Terzaghi equation. For $\varphi$ = 350 Terzaghi's bearing capacity factors are Nc =57.8 Nq =41.4 and Nr =42.4
12. Explain the Plate load test in details with neat sketch.
13. Explain bearing capacity measurement on granular soil based on SPT.
14. Explain the Skempton"s values for Nc. Derive the equation for the same.
15. Discuss the concept of differential settlement, its causes and measures to avoid differential settlement.

**Module 3: Foundation for difficult soils**

1. Explain the guidelines for weak soils.
2. Explain the guidelines for compressible soils.

3. Explain the guidelines for expansive soils.
4. Explain the problems involved while designing the foundation on expansive soils.
5. Enlist and discuss the preventive measures to be taken while designing the foundation on collapsible soils.
6. Explain the problems involved while designing the foundation on collapsible soils.
7. Enlist and discuss the preventive measures to be taken while designing the foundation on expansive soils.
8. Discuss the causes of moisture changes in soils.
9. Enlist and explain the ground improvement techniques.
10. Explain the mechanical and chemical stabilization methods in brief.
11. Enlist and explain different methods of soil compaction.
12. Explain the compaction methods for cohesive and cohesionless soils in brief.
13. Explain briefly with sketch on "controlling water's access to the soil" guidelines for construction on expansive soil
14. Explain briefly with sketch on "altering the soil" guideline for construction on expansive soil
15. Explain briefly with sketch on "Altering the method of construction" guideline for construction on expansive soil

**Module 4: Shallow Foundation**

1. Define shallow foundation and explain types of shallow foundation.
2. Define Mat/raft footing and explain under what circumstances, a Mat/Raft footing is adopted?
3. Explain the assumptions and limitations of rigid design analysis.
4. Design the foundation to support the two columns with uniform contact pressure: P1= 750 kN, P2 = 1050 kN, cross section for both the columns is (50cm × 50cm). C/C spacing between the columns is 5 m. Assume the net allowable soil pressure is 200 kN/m2.
5. What are the assumptions made in combined footing design?
6. When a trapezoidal combined footing is is preferred to as a rectangular one? Explain how it is proportioned.
7. Explain the general considerations in the design of raft foundation.
8. Describe step by step procedure for geometrical designing the isolated shallow footing.
9. Describe step by step procedure for geometrical designing the rectangular combined footing.

10. Draw the contact pressure distribution diagram for a flexible and rigid footing resting on
    a) Cohesive soil b) Cohesionless soil
11. Design of combined footing for two adjacent column using following details
    Load on each column – 800kN
    Size of each column – 500mm X 500mm
    c/c spacing of column – 3.0m
    SBC of soil - 100kN/m2. Justify footing type you use.
12. Design of combined footing for two adjacent columns using following details
    Load on external column – 600kN
    Load on internal column – 800kN
    c/c distance between column – 3.6m
    Size of each column – 450mm
    External column is flushed with boundary
    SBC of soil – 200kN/m2
    Draw plan and elevation of footing with design dimensions
13. Design of combined footing for two adjacent columns using following data
    Load on external column – 800kN
    Load on internal column – 600kN
    c/c distance between column – 3.6m
    Size of each column – 400mm
    Clear distance of external column from boundary – 0.2m
    SBC of soil – 200kN/m2. Assume length of footing – 4.5m. Draw plan and elevation of footing with designed dimensions
14. Explain the IS code method for designing Raft foundation.
15. Explain the rigid analysis method for designing strip footing.

**Module 5: Deep Foundation**

1. List out the type of pile based on material used.
2. Explain the factors consider while selecting the type of pile.
3. Explain the methods to determine the load carrying capacity of a pile.
4. State and explain the type of pile based on load transfer mechanism.
5. Explain any two types of piles in detail based on material used.
6. Define and explain load carrying capacity of single pile.
7. Define and explain load carrying capacity of group piles.
8. Explain calculation of Point Bearing Load by using Meyerhof method.

9. A concrete pile is 20 m length and 360 mm x 360 mm in cross section. The pile is fully embedded in sand which unit weight is 16.8 kN/m3 and $\phi = 30°$.
   You are given also $Nq* = 56.7$. Calculate:
   a) The ultimate load (Qp), by using Meyerhof's method.
   b) Determine the frictional resistance (Qs), if $k = 1.3$ and $\delta = 0.8\phi$.
   c) Estimate the allowable load carrying capacity of the pile (Use FS = 4).
10. Define and explain the types of Sheet Piles.
11. Define cassions foundation and state different types of cassions foundation.
12. Discuss the term negative skin friction in piles.
13. A pile is driven through soft cohesive deposit overlying stiff clay, the average un-drained shear strength in the soft clay is 45 kPa and in the lower deposit the average un-drained shear strength is 160 kPa. The water table is 5 m below the ground and the stiff clay is at 8 m depth. The unit weights are 17.5 kN/m3 and 19 kN/m3 for the soft and the stiff clay respectively. Estimate the length of 500 mm diameter pile to carry a load of 500 kN with a factor of safety Fs = 4. Using $\alpha -$ method
14. Explain pile load test in details with neat sketch.
15. Explain group action of piles.

**Module 6: Slope Stability**

1. State and explain the causes for failure of slope.
2. State and explain the types of slip surfaces or failure surfaces with neat sketches.
3. Enlist the method of analysis for stability of a finite slope and explain any two methods in detail.
4. Define a) slope failure b) face failure c) toe failure d) base failure.
5. Discuss how the stability of slope of an earthen dam will you analyze.
6. Explain the Swedish Circle method of Analysis of slopes.
7. Explain the friction Circle method of analysis of stability of slopes.
8. Explain the Cullman's method of analysis of stability of slopes.
9. Explain the Bishop's method of analysis of stability of slopes.
10. Give the method of slope protection measures. Explain briefly.
11. Write down the assumptions of Rankine's theory.
12. What are assumptions in coulomb wedge theory?
13. Analyse infinite slope, having following details
    Soil – clay ($r = 18kN/m^3$, $c = 40\ kN/m^2$ and $\Phi = 0^0$)
    Slope angle – $25^0$
    Height of slope – 7m

14. Determine factor of safety of slope of purely cohesive soil having cohesion is 30kN/m², γ= 17kN/m$^3$ φ=10$^0$, radius of slip surface = 10.8m, angle subtended at centre =115$^0$. The C.G. of wedges is horizontally 3.5m away from Centre of slip surface. Take area of wedge 124m². Use friction circle method. Assume slope angle – 50$^0$ and height of slope – 8m
15. Analyze infinite slope, having following details

    Soil – silt,

    Slope angle – 250 (r = 18kN/m3,$r_{sat} = 21$ kN/m3, c = 20 kN/m2 , Φ =300),

    Height of slope – 7m

    Water table – 2m below ground level. Seepage is parallel to slope.

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