TE/civil/sem-VI/CBCGS/R-19/c-scheme/GE-II/SH-25

05/12/2025

Time: 3 hours **Total marks: 80**

QP-10099915

Q. No. 1 is compulsory and attempt any three of the remaining questions.
Assume sutiable data (if necessary) with justification.
Figures to the right indicate full marks.

1. Answer any 4 (out of 6) questions:
   a) Explain spring analogy for primary consolidation with neat diagram(s). **5**
   b) Classify shear tests of soils on the basis of drainage conditions. **5**
   c) Explain the different types of slope failures with neat diagram(s). **5**
   d) Differentiate between Rankine's & Coulomb's theories of lateral earth pressure. **5**
   e) Differentiate between general and local shear failure of shallow foundations with neat diagram(s) **5**
   f) Explain five different conditions when pile foundations are preferred instead of shallow foundations. **5**

2. a) A 3 m thick layer of saturated clay lies in between two permeable layers and has the following properties: liquid limit: 40%, coefficient of permeability: 2.7×10^{-7} cm/s, initial voids ratio: 1.20. The initial and final overburden pressure are 2 kg/cm^2 and 4 kg/cm^2 respectively. Determine the final voids ratio, settlement and time required for 50% consolidation. **10**
   b) Direct shear test was carried out on sand and the sample failed at a shear stress of 80 kN/m^2, when the normal stress was 160 kN/m^2. Draw the Mohr's circle, failure envelope and principal planes. Also, determine the principal stresses. **10**

3. a) Explain with the help of neat diagram, how to determine pre-consolidation pressure of soil. **5**
   b) A 10 m high cut has been made at an angle of 38^0 to the horizontal. A possible circular failure surface has a radius of 22 m and is passing through the toe of the cut slope and through a point 5 m away on the top ground from the edge of the cut. The weight of the failure mass is 1500 kN and its centre of gravity is at a distance 10 m from the centre of the failure circle. The properties of soil are c = 40 kN/m^2, $\varphi = 18^0$ and Υ = 20 kN/m^3. Determine factor of safety that would be available on the said failure surface for the cut. Use friction circle method. **10**
   c) Write a short note on Taylor's stability number. **5**

4. a) Determine the active earth thrust and its point of application on a retaining wall of height 6m with horizontal backfill, carrying a surcharge of 10 kN/m^2. It has a water table at a depth of 2.5 m. The dry unit weight of soil above the water table is 12.5 kN/m^3 and the saturated unit weight of soil below the water table is 20 kN/m^3. The angles of internal friction of the soil above and below the water table are 30^0 and 45^0 respectively. **10**

b) With the help of neat sketch, explain Culmann's graphical method in detail. How can this method be extended to include the effect of uniform surcharge or live load applied to the backfill? **10**

5. a) State the assumptions of Terzahi's theory of bearing capacity of shallow foundations. **5**

b) Explain the effect of water table on the bearing capacity of shallow foundations. **5**

c) A chimney with a rigid base 2.5 m square footing is placed at a depth of 1.2 m below the ground level. The soil is clay with $c = 30$ kN/m^2 and unit weight of 19.7 kN/m^3. The weight of the chimney is 100 kN and it has a resultant wind load of 25 kN acting at a height of 1.2 m above the ground level acting parallel to both of the sides. Determine the factor of safety with respect to bearing capacity using Vesic's theory. **10**

6. a) Explain any one dynamic formulae of determination of load carrying capacity of piles. **5**

b) A pile of 450 mm diameter and 10.5 m length is driven in a deposit having deposit having $c = 0$, $\phi = 30^0$, $\Upsilon = 16.5$ kN/m^3 and $\Upsilon_{sat} = 18.5$ kN/m^3. Considering critical depth to be 15 times the diameter of the pile, $N_q = 35$, $k = 3.2$ and $\delta = 20^0$, calculate the safe load that the pile can carry if the water table is located at a depth of 2.5 m from the ground level. Assume FOS = 2. **10**

c) Explain negative skin friction with neat diagram. **5**

****

LIB - 5/12/2025

LiB. 5/12/25

sem-VI