Graphic Era HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: B.Tech. 5th Semester
Name of the Paper: Geotechnical and Foundation Engineering
Paper Code: TCE 503

Time: 3 hour Maximum Marks: 100

Note:

(i) All the questions are compulsory.
(ii) Answer any two sub questions from a, b and c in each main question.
(iii) Total marks for each question is 20 (twenty).
(iv) Each sub-question carries 10 marks.

Q1. (2X10=20 Marks) **CO 1**

a. Explain the importance of soil exploration program. Explain two methods of subsurface exploration

b. Explain the following Geophysical Tests (Seismic Refraction Method, Electrical Resistivity Method).

c. Enlist and explain about various types of boring along with a neat diagram.

Q2. (2X10=20 Marks) **CO 2**

a. A gravity retaining wall retains 12 m of a backfill, $\gamma = 17.7$ kN/m^3 $\varphi = 25°$ with a uniform horizontal surface. Assume the wall interface to be vertical, determine the magnitude and point of application of the total active pressure. If the water table is a height of 6 m, how far do the magnitude and the point of application of active pressure changed?

b. A retaining wall, 8 m high, retains a cohesionless backfill. The top 4 m of the fill has a unit weight of 18 kN/m^3 and $\varphi = 30°$ and the rest has unit weight of 24 kN/m^3 and $\varphi = 20°$. Determine the active and passive pressure distribution on the wall. Make pressure diagram also.

c. Explain the following terms related to earth retaining structures along with the help of diagram. Sheet pile wall and its types, Anchored Bulkhead, Coffer Dams, and Braced Cuts.

Q3. (2X10=20 Marks) **CO 3**

a. Enlist assumptions of Terzaghi theory. Explain different types of shear failure of shallow foundation.

b. Compute the safe bearing capacity of a continuous footing 1.8 m wide,and located at a depth of 1.2 m below ground level in a soil with unit weight $\gamma = 20$ kN/m^3, $c = 20$ kN/m^2, and $\varphi = 20°$. Assume a factor of safety of 2.5. Terzaghi's bearing capacity factors for $f = 20°$ are $N_c = 17.7$, $N_q = 7.4$, and $N_\gamma = 5.0$, what is the permissible load per metre run of the footing ?

c. In a borehole, a layer of fine sand was encountered at a depth of 5m from the ground surface. A dense sand layer of density 16 kN/m^3 overlies the fine sand layer of density 14kN/m^3. The Average N value recorded in the field was 23. Determine the correct N value for the layer at 5m depth. The water table was found to be at a depth of 2m from surface. Determine the bearing capacity of a square footing 2.0 m wide and use Peck Henson's equation.

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Q4. (2X10=20 Marks) **CO 4**

a. Explain the necessity of using a pile foundation. Classify the pile foundations (only name) on the behalf of function and method of installation with the help of neat diagram.

b. A group of 16 piles of 50 cm diameter is arranged with a centre to centre spacing of 1.0 m. The piles are 9 m long and are embedded in soft clay with cohesion 30 kN/m2. Bearing resistance may be neglected for the piles—Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group.

c. A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of the piles were 30 cm and 9 m respectively. If the unconfined compression strength of the clay is 90 kN/m^2, and the pile spacing is 90 cm centre to centre, what is the capacity of the group? Assume a factor of safety of 2.5 and adhesion factor of 0.75.

Q5. (2X10=20 Marks) **CO 5**

a. An embankment 10 m high is inclined at an angle of 36° to the horizontal. A stability analysis by the method of slices gives the following forces per running meter:

Σ Shearing forces = 450 kN
Σ Normal forces = 900 kN
Σ Neutral forces = 216 kN

The length of the failure arc is 27 m. Laboratory tests on the soil indicate the effective values c′ and φ′ as 20 kN/m^2 and 18° respectively. Determine the factor of safety of the slope with respect to (a) shearing strength and (b) cohesion.

b. Explain taylor's stability chart method for analysis of finite slope. A cutting is to be made in clay for which the cohesion is 35 kN/m^2 and $\phi = 0°$. The density of the soil is 20 kN/m^3. Find the maximum depth for a cutting of side slope 2:1 if the factor of safety is to be 1.5. Take the stability number for a 2:1 slope and $\phi = 0°$ as 0.17

c. Derive an expression for FOS for stability of soil slopes in infinite C-ϕ deposits with neat diagram.