Enrollment ID: _____

Navrachana University

School of Engineering and Technology and B. Tech Civil Engineering

End-Semester Examination November 2023

Fourth-year and VII-Semester

Geotechnical Engineering-II and CE 302

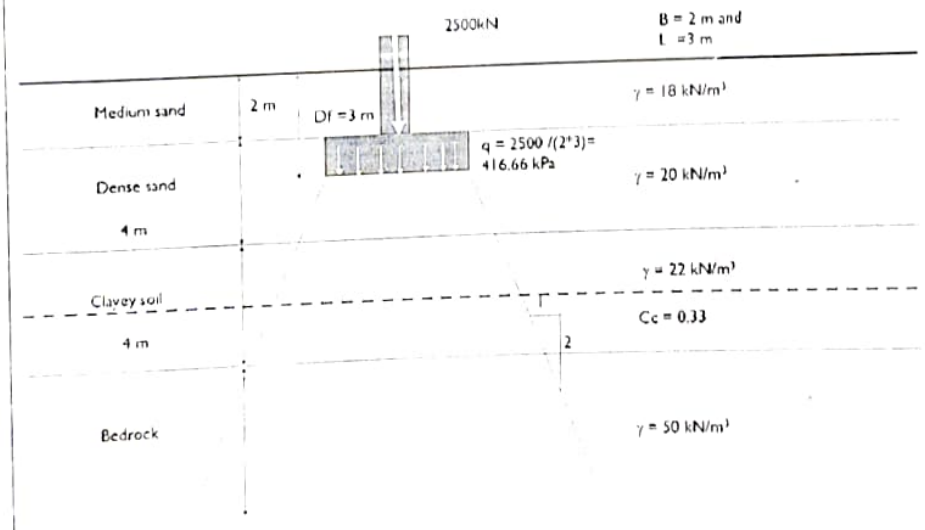
Marks: 20

Date: 21/11/2023

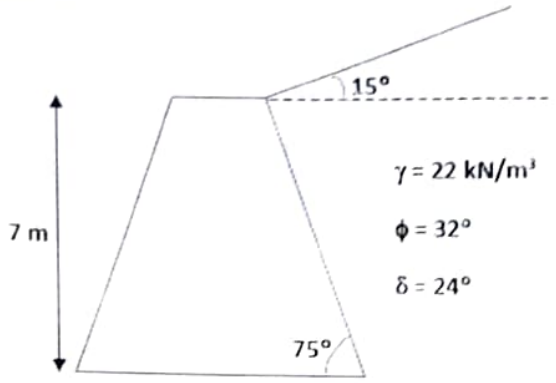
Time: 10:00 am to 11:30 am (1.5 Hrs)

Instructions:

- Write each answer on a new page
- Use of a calculator is permitted
- Indian Standards: IS 6403 and IS 8009-Part 1 are allowed
- Formulations and Graphs required as a reference to solve numericals are attached with the paper

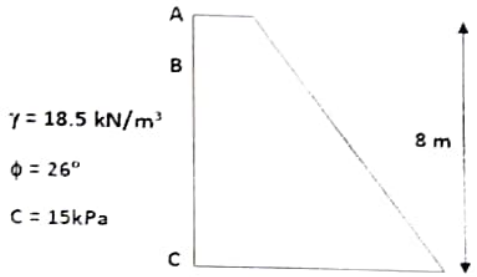
Questions	Marks	CO	BTL
Q1. A rectangular footing of 1.5 m x 3 m is laid at a depth of 2.5 m below the ground surface. Determine the net bearing capacity using the IS 6403 code method; assume General Shear Failure/ Local Shear Failure according to your understanding. Consider the following properties of soil: γ = 21 kN/m^3; ϕ = 38°; RD = 89%; load is inclined at an angle of 15° w.r.t vertical direction and the water table is located at a depth of 1.5 m from the base of the foundation.	(06)	2	2,3,5
Q2. Determine the primary settlement of the foundation due to clay layer shown in figure below. 	(04)	2	2,3,5

Q3. Determine the Coulomb active and passive force on the retaining wall shown in the Fig below.	(05)	3	2,3,5



OR

Q3 . A 5m high retaining wall is shown in the figure below. Determine the Rankine active pressure on the wall. (a) Before the formation of the crack, (b) After the formation of the crack.	(05)	3	2,3,5



Q4. A long natural slope in an overconsolidated clay (c' = 10 kPa and ϕ= 25°, γ_{sat} =20 kN/m²) is inclined at 10° to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip has developed at a depth of 5 m below the surface, determine the factor of safety. Take γ_w = 10 kN/m³	(05)	5	2,3,5

OR

Q4. A vertical cut is made through a homogeneous soil mass, c = 35kN/m; ϕ =20° and γ = 16.5 kN/m³). Using Culmann's method, determine the safe depth of the cut, and stability number, taking a factor of safety of 2.0.	(05)	5	2,3,5

Formulations and Graphs

$$K_a = \cos i \times \frac{\cos i - \sqrt{\cos^2 i - \cos^2 \phi'}}{\cos i + \sqrt{\cos^2 i - \cos^2 \phi'}}$$

$$K_a = (1 - \sin \phi)/(1 + \sin \phi)$$

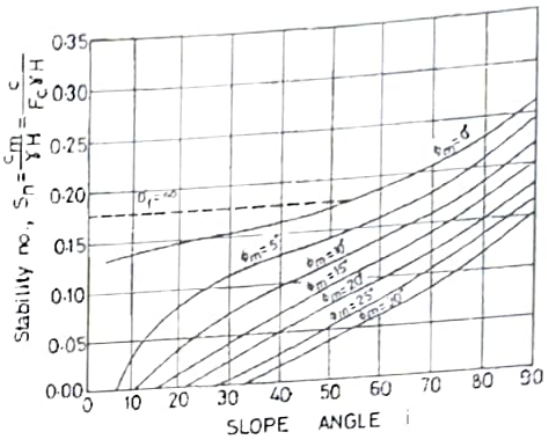
$$K_p = (1 + \sin \phi)/(1 - \sin \phi)$$

$$K_p = \cos i \frac{\cos i + \sqrt{\cos^2 i - \cos^2 \varphi'}}{\cos i - \sqrt{\cos^2 i - \cos^2 \varphi'}}$$

$$\Delta s(i) = C_c \frac{H_i}{1 + e_o(i)} \log \left(\frac{\bar{\sigma}_o + \Delta \sigma_i}{\bar{\sigma}_o} \right)$$

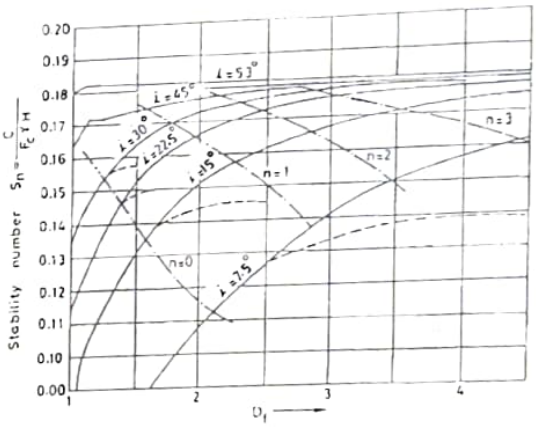
$$K_a = \frac{\sin^2(\beta + \phi')}{\sin^2 \beta \sin(\beta - \delta) \left[1 + \sqrt{\frac{\sin(\phi' + \delta) \sin(\phi' - i)}{\sin(\beta - \delta) \sin(\beta + i)}} \right]^2}$$

$$K_p = \frac{\sin^2(\beta - \phi')}{\sin^2 \beta \cdot \sin(\beta + \delta) \left[1 - \sqrt{\frac{\sin(\phi' + \delta) \sin(\phi' + i)}{\sin(\beta + \delta) \sin(\beta + i)}} \right]^2}$$



$$\sigma_h = K_a \sigma_v - 2c\sqrt{K_a}$$

$$\sigma_h = K_p \sigma_v + 2c\sqrt{K_p}$$



**********End of Question Paper**********