Ref. No.: Ex/CE/5/T/302/2024(S)

BACHELOR OF ENGINEERING (CIVIL ENGINEERING) THIRD YEAR
FIRST SEMESTER SUPPLEMENTARY EXAMINATION 2024

SOIL MECHANICS - I (Part-I)

Total Time: Three Hours | Full Marks: 100 (60+40)

Use separate answer script for each Part

Answer all the questions

Answer should be brief and to the point.

Assume any data reasonably if needed

1. (a) Draw the phase diagram for completely dry and fully saturated soil mass. (2)

   (b) Differentiate between air content and percentage air voids. (2)

   (c) Define Sensitivity and Thixotropy for a soil. (2)

   (d) A soil has bulk density of 20.1 kN/m^3 and water content of 15%. Calculate the water content if the soil partially dries to density of 19.4 kN/m^3 and void ratio remains unchanged. (4)

   (e) A partially saturated soil samples collected from a pit has a natural moisture content of 18% and bulk unit weight of 20 kN/m^3. G = 2.68. Estimate the void ratio and degree of saturation. What will be the unit weight of the soil sample on saturation? (10)

2. (a) Differentiate between discharge and seepage velocity. (2)

   (b) What is meant by total stress, neutral stress and effective stress? Write the relationship between them. (3)

   (c) A layer of saturated clay 4 m thick is overlain by sand 5 m deep, the water table is 3 m below the ground surface. Saturated unit weight for clay is 19 kN/ m^3 and sand is 20 kN/ m^3. Bulk unit weight of sand above water table is 17 kN/m^3. Plot the total stress, effective stress against depth. If sand is saturated with capillary water upto a height of 1 m above water table, how are the above stress affected.? (10)

   (d) For a homogeneous earth dam 52 m high and 2 m freeboard, a flow net was constructed and following results were obtained: (5)
   Number of potential drops= 25
   Number of flow channels = 4
   Calculate the discharge per metre length of the dam, if the coefficient of permeability of the dam material is 3 x 10^{-5} m/sec. Also estimate the exit gradient if the average length of the last flow field is 0.9 m.

3. (a) Explain the triaxial shear tests based on drainage and their applicability. (5)

   (b) Write a note on unconfined compression tests and its advantages and disadvantages. (5)

   (c) The following results were obtained from direct shear test on soil. (10)

Normal load (N)	250	500	750
Failure load (N)	320	400	610

   Determine shear strength parameters. The cross-sectional area of shear box was 36 cm^2.

Ex/CE/5/T/302/2024(S)

B. E. (CIVIL ENGIEERING) THIRD YEAR FIRST SEMESTER EXAM 2024

SOIL MECHANICS -I

PART-II

Time: Three Hours | Full Marks 100 (40 marks for Part II)

Use a separate Answer-Script for each part

<table>
<tr><th>No. of questions</th><th></th><th>Marks (40)</th></tr>
<tr><td>1)</td><td>The following data were recorded while performing the compaction test:

<table><tr><td>Water content (%)</td><td>8</td><td>11.5</td><td>14.5</td><td>17.5</td><td>19.5</td><td>21.5</td></tr><tr><td>Mass of wet soil (gm)</td><td>1.7</td><td>1.9</td><td>2</td><td>1.98</td><td>1.95</td><td>1.92</td></tr></table>
Provided size of the compaction mould is 950 cc, and G = 2.68; find the following:-
(i) Plot the compaction curve and find the optimum water content and maximum dry density.
(ii) Find air void percentage, degree of saturation at maximum dry density.
(iii) Plot 100 % saturation line and find theoretical maximum dry density at OMC.</td><td>10</td></tr>
<tr><td>2)</td><td>A 8 m thick sand layer overlies a 6 m thick layer of clay below which is another sand layer. For the clay, mv = 10^{-3} m^2/kN and c_v= 10^{-7} m^2/s. The water table is at ground surface but is to be lowered permanently by 4 m over a period of 6 months. Calculate the ultimate settlement due to the consolidation of clay assuming no change in the weight of sand.</td><td>8</td></tr>
<tr><td>3)</td><td>A normally consolidated clay layer settled by 20 mm when the effective stress was increased from 25 to 50 kN/m^2. What will be its settlement when the effective stress is increased from 50 to 100 kN/m^2?</td><td>6</td></tr>
<tr><td>4)</td><td>Write short note on the following:-
(a) Clay minerals and it's broad based classification
(b) Typical compaction curve of sand and bulking of sand
(c) Consolidation of soil and degree of consolidation
(d) Basic assumptions of Terzaghi's one dimensional consolidation theory</td><td>4 X 4=16</td></tr>
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