JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST - 3 EXAMINATION - May 2018

B. Tech. IV Semester

COURSE CODE: 10B11CE411   MAX. MARKS: 35

COURSE NAME: GEOTECHNICAL ENGINEERING

COURSE CREDITS: 04   MAX. TIME: 2Hrs

Note: All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means. Assume data wherever necessary.

[1] The subsoil at a site consists of a 10 m thick homogeneous layer of dense sand having the following properties:

$$\gamma_d = 1.62 \text{ gm/cc}; \ G = 2.68; \ \phi = 35°$$

The natural ground water table lies at 2 m below the ground surface. Determine:
- (i) Shear strength of soil along the horizontal plane through the middle of sand layer
- (ii) If during monsoon, the water table rises to the ground level, how will the shear strength along the same plane change?

Assume that the soil is dry above water table.   [3+2 = 5]

[2] Write a short note on unconfined compressive strength test. With the help of Mohr – circle deduce the relationship between undrained shear strength and unconfined compressive strength of clay.   [3]

[3] A 6 m thick clay stratum is overlain by a 8m thick stratum of coarse sand and is underlain by an impermeable rock. A footing, supporting the columns of a building is to be founded at a depth of 1.2 m below ground level. The size of the footing is 8.5 m (Length) x 13.6 m (width), and it is loaded uniformly with a stress intensity of 9.2 t/m². The water table is located at 2 m below the ground level. The unit weight of sand above and below the water table are 1.90 and 2.10 t/m³. The properties of the clay are as follows:

$e_0 = 0.72$; $G = 2.71$; $w_L = 42\%$; coefficient of consolidation = 2.2 x 10⁻³ cm²/sec

Determine:
- (i) Probable settlement of the footing
- (ii) The time required to undergo a settlement of 5 cm.   [4+4 = 8]

[4] What is phreatic line? Describe the principle and procedure to draw the first flow line for an unconfined flow. Derive the expression for discharge through the body of an earthen dam with filter clearly bringing out the significance of locating the phreatic line. [5]

[5] Derive Terzaghi's one – dimensional consolidation, stating all the assumptions and their significance. Also describe the solution for Terzaghi's consolidation equation and its significance in consolidation determination. [5]

[6] Describe the different types of triaxial tests elaborating both the consolidating and drainage stages. With reference to stress – strain, volume change and pore water pressure, describe shear strength of sand and clay. [3]

[7] Given the flow situation shown in the figure.
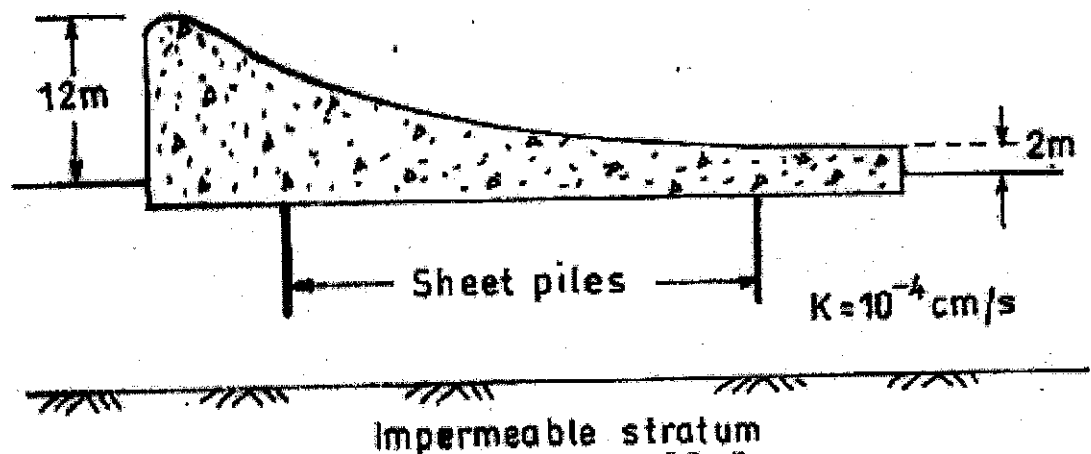
a) Is this a case of confined or unconfined flow?

b) What are the boundary conditions for the flow situation depicted in the figure?

c) A flownet drawn for this condition gives $n_f = 3$; $n_d = 30$. What is the quantity of flow per metre run occurring under the weir?

d) The elementary square at the toe of the weir has dimensions of 0.6 m. What is the exit gradient?

e) For what reservoir height would the exit gradient be equal to 1? What is the implication of condition to the safety of the weir? [1+1+1+1+2 = 6]