THAPAR INSITUTE OF ENGG. AND TECHNOLOGY, PATIALA

CE-008 SOIL MECHANICS

B.E. THIRD YEAR (CIVIL) END SEMESTER EXAMINATION

Time: 3HRS. **Max. Marks: 100**

Note: Q.No.1 is compulsory. Attempt five questions in all. Assume missing data suitably.

Q.No.1 Check whether following statements are true or false. Justify your answer with reason.

(a) Gap graded soil has particles of one size.
(b) The shear strength of all soils at plastic limit is different.
(c) Greater the over-consolidation ratio for a clay, lesser the settlement under a given stress increase.
(d) Always buy moist sand by volume.
(e) The field consolidation curve is generally steeper than lab curve.
(f) At critical void ratio, the volume change during shear is maximum.
(g) The pore water pressure during a shear test on over-consolidated clay is negative.
(h) In unconfined compression test, the Mohr's circle passes through origin.
(i) The soils compacted dry of optimum have higher permeability than those on wet side.
(j) In UU test, effective stress parameters are obtained. **(10x2=20)**

Q.No.2 (a) What is 'silica tetrahedron' and an 'aluminum octahedron'? How are silica sheet and aluminum sheet are formed? Draw their sketches.

(b) Establish the following from basic relationship:

$$S = \frac{w}{\gamma_w / \gamma\,(1+w) - 1/G}$$

where the notations has their usual meaning.

(c) Distilled water was added to 60 gm of dry soil to prepare a suspension of 1litre. What will be the reading of hydrometer in the suspension at t=0 sec, if the hydrometer could be immersed at that time? $G=2.70$, γ_w = 1gm/cc **(5,10,5)**

Q.N.3 (a) In a container filled with each of the following materials, at a porosity of 40%, determine the upward gradient required to cause the quick condition: (a) lead shot with a $G=11.35$; (b) fibre beads with $G=1.55$; (c) sand with a $G=2.65$

(b) Draw the flow net for the structure on a soil of permeability of 3×10^{-5} m/s as shown in fig.1 Also determine quantity of seepage and uplift pressure. **(8,12)**

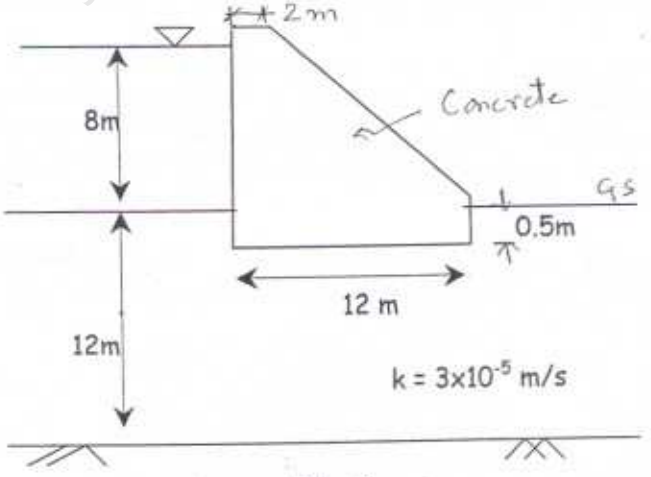

Fig. 1

Q.No4 (a) Two long boundary walls run parallel to each other at a centre-to-centre distance of 1m apart. The width and height of the first wall are 0.20m and 2m respectively, while those of the second are respectively 0.10m and 3m. Plot the distribution of vertical stress intensity due to walls on a horizontal plane, 1m below ground level. The walls have negligible depth of foundation and are made of brick masonry. (γ = 19.2 kN/m^3)

(b) An embankment of trapezoidal cross-section is to be constructed for a 2km long highway. The embankment should have a height of 2.2m and a top width of 10m. The sides of the embankment are to be sloped at 2H: 1V. The soil obtained from borrow area is tested in the laboratory and is found to have following properties: natural moisture content = 12%, In-situ bulk density = 18kN/m^3,*OMC* = 19%, dry density at *OMC* = 16.5kN/m^3. Determine the quantity of soil to be excavated and the quantity of water to be added to it before constructing the embankment **(12,8)**

Q.No.5(a) An oedometer test was conducted on a specimen of clay (G=2.7) and following dial gauge readings were obtained 24hours after the application of each stress increment:

Stress (kN/m^2)	0	100	200	400	800	1600	0
Dial Reading (mm)	10	9.5	9.10	8.45	7.6	6.67	6.4

The initial thickness of the specimen was 20mm and final water content (w_f = 22%). This clay stratum in the field is 5m thick and is likely to be subjected to a stress increment of 600-800kN/m^2. What will be settlement of the clay stratum?

(b) The vaid ratio of clay A decreased from 0.572 to 0.505 under a change in pressure from 120 to 180 kg/m^2. The void ratio of clay B decreased from 0.612 to 0.597 under same pressure increment. The thickness of sample A was 1.5 times that of B. Nevertheless the time required for 50% consolidation was three times longer foe sample B than for sample A. What is ratio of coefficient of permeability of A to that of B? **(10,10)**

Q.No.6 (a) Differentiate between NC and OC soils. Draw curves for (i) Stress vs Strain (ii) Volume change vs Strain (iii) Pore pressure vs Strain for these soils.

(b) The results of a series of CU tests on undisturbed samples of an OC clay were as below:

Cell Pressure (kN/m^2)	100	300	500	600
Deviator stress at failure (kN/m^2)	130	485	645	850
Pore water pressure at failure (kN/m^2)	-45	-15	50	110

Determine the effective shear strength parameters. Determine the values of A_f with the overconsolidation ratio, if the preconsolidation stress of the clay is 500 kN/m^2. **(8,12)**

Q.No.7 (a) In a falling head permeability test on a soil of length L, the head of water in the stand pipe takes 5 sec to fall from 900 to 135mm above the tail water level. When another soil of length 60mm is placed on the first soil, the time taken for the head to fall between the same limits is 150 sec. The permeameter has a x-sectional area of 4560mm^2 and a stand pipe area of 130mm^2. Calculate the permeability of second soil.

(b) A vane 10.8cm long, 7.2cm in dia was pressed into a soft clay at the bottom of borehole. Torque was applied and the value at failure was 45N-m. Find the shear strength of the clay on a horizontal plane. **(12,8)**