M. E. (Soil Mech. & Foundation Engg.) 1st Semester Examination, December 2013

ADVANCED SOIL MECHANICS - I (CE-908)

Time: 3 hours Full Marks: 100

Assume any data, if required reasonably

All questions carry equal marks

Answer question No. 7 and any Four from the rest

1. (a) Enumerate the sources of electrical charges on clay particles?
   (b) Explain the followings:
   (i) Exchangeable cations
   (ii) Hydration of clays
   (iii) Factors controlling the properties of clay materials

5+15 = 20

2. (a) Derive the expression for Skempton's pore pressure parameters (A and B).
   (b) How these parameters can be determined in the laboratory?
   (c) The following results were obtained from undrained triaxial compression test on specimen of clayey silt:

Specimen No.	σ_3 (kPa)	σ_1 (kPa) at failure	U_i (kPa) at failure	u_f (kPa) at failure
1	70	115	45	60
2	140	205	100	120
3	210	295	140	190

Determine the values of the Skempton's pore pressure parameters from the above test results and infer about the soil

8+4+8 = 20

3. (a) Explain with neat sketch the logarithmic spiral method for evaluating passive earth pressure on wall retains c-ϕ soil at its back.
   (b) A gravity retaining wall retains 12 m uniform horizontal backfill, γ = 18 kN/m^3 and ϕ = 30^0. Assuming the wall interface to be vertical, determine the magnitude of active and passive earth pressures. Assume the angle of wall friction to be 20^0. Determine the point of action also.

10+10=20

4. (a) Define stress path.
   (b) Prove the followings:
   (i) $\tan\alpha = \sin\phi$
   (ii) $c = \frac{a}{\cos\phi}$, the symbols are used for their usual meanings.
   (c) Enumerate the corrections used in triaxial tests.

5+10+5 = 20

5. (a) Differentiate critically the classical earth pressure theories of Rankine and Coulomb.
(b) Describe Culmann's graphical method for finding earth pressure.
(c) A retaining wall of 10 m height retains cohesionless backfill. The void ratio and angle of shearing resistance of the backfill, in its loose state, are 0.7 and 30^0 respectively and they are 0.4 and 40^0 in dense state. For the soil grain G=2.7. Estimate and compare active and passive earth pressures in both cases.

8+6+6=20

6. (a) Explain DTA for identification of clay minerals
(b) Describe structures of any three clay minerals highlighting the role of clay minerals on the engineering properties of soils.

5+15 = 20

7. Write short notes on any **FOUR** from the following:
(a) Diffuse ion layer
(b) Mohr-Coulomb failure theory
(c) Special triaxial tests
(d) Active earth pressure on wall with inclined (upward) backfill, when $\beta = \phi$,
(e) Bell's equation from Mohr circle
(f) Stability of Retaining wall

4x5= 20