M. E. (Geotech. Engg.) 1st Semester Examination, December 2012

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. One and any Four from the rest

1. Write short notes on any **FOUR** from the following:
   (a) Electrical charges on clay particles
   (b) Mohr-Coulomb failure theory
   (c) Earth pressure at rest
   (d) Merits and demerits of Rankine's and Coulomb's earth pressure theories
   (e) Bell's equation from Mohr circle
   (f) Advantages of steel sheet piles

   4@5= 20

2. (a) Discuss interaction of clay particles?
   (b) Explain the followings:
   (i) Factors controlling the properties of clay materials
   (ii) Hydration of clays
   (iii) Exchangeable cations

   5+15 = 20

3. (a) Explain X-ray Diffraction test for identification of clay minerals
   (b) Describe structures of Montmorillonite, Clay mica and Kaolinite clay minerals highlighting the role of clay minerals on the engineering properties of soils.

   5+15 = 20

4. (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 in a consolidated undrained triaxial compression test of a saturated specimens of clayey silt:

Specimen No.	σ_3 (kPa)	σ_d (kPa) at failure	u_f (kPa) at failure
1	150	190	80
2	300	340	150
3	450	500	220

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

   8+4+8 = 20

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

   5+10+5 = 20

contd.

6. (a) Enumerate the conditions under which Rankine's and Coulomb's earth pressure theories are applicable under active state

(b) A 7.0 m high earth retaining structure was constructed to retain two layers of backfill.

The properties of the layers are as follows:

Layer I	Layer II
Thickness = 3.5 m	Thickness = 3.5 m
c=0 kPa, ϕ=30°, γ=17.6 kN/m^3	c=20 kPa, ϕ=20°, γsat=18.5 kN/m^3

The water table is located at 3.5 m below GL

Draw the active earth pressure diagram.

Compute total active earth pressure on the structure and find out the point of application

8+12=20

7. (a)Explain the effect of wall friction on earth pressure.

(b)Enumerate the steps for computing passive earth pressure for retaining wall having backfill as c-ϕ soil using logarithmic spiral method with suitable example.

5+15= 20

8. (a)Deduce the expressions for the embedment depth of an anchored bulkhead with homogeneous granular soil above and below the dredge line.

(b) An anchored retaining wall of 6.0 m high has been constructed with water on both the sides of the wall and granular soil above and below the dredge line. The saturated density of the soil is γ_{sat} = 19.0 kN/m^3 and angle of internal friction, ϕ = 30°.

Compute the embedment length and pull in the anchor rod.

10+10=20