B.E.(C.E.) Part III Examinations 2012

6 th Semester Civil Engineering

Soil Mechanics II

(CE 603)

Full Marks: 70 Time: 3 Hours

FIRST HALF

Attempt **Q. No. 1** and **any two** from the rest

Assume reasonable value for any data not supplied.

1. (a) State three important differences between Rankine's and Coulomb's earth pressure theories.

(b) An anchored bulkhead has to retain a backfill of cohesionless soil up to 6 m above the dredge level. The water table and the anchor rods are at 2.0 m and 1.5 m respectively below the top of the backfill. The void ratio and the specific gravity of soil solids, both above and below dredge level, are 0.88 and 2.67 respectively. The water content of the soil is 4% above the water table and 25% below it, while the angle of internal friction is 33° and 29° respectively above and below water table. The c/c spacing of anchor rods is 3.0 m. Determine the required depth of embedment of the bulkhead with respect to a factor of safety of 2.0. Also find the force in each anchor rod. Use the fixed earth support method. Given, for $\phi = 29°$, $x = 0.053H$, where H = overall height of the backfill. [3+12=15]

2. (a) Define 'earth pressure at rest'. Give a practical example where such a state may exist.

(b) A masonry retaining wall, 4.5 m high, supports a backfill of cohesionless soil with a horizontal surface. The back of the wall is vertical. The backfill has the following properties:

void ratio = 0.83

specific gravity of solids = 2.65

angle of internal friction = 27.5°

degree of saturation above water table = 10%

The ground water table is at 2.2 m below the top of the wall. Plot the distribution of active earth pressure on the wall and determine the magnitude and point of application of the resultant active thrust. [3+7=10]

3. A gravity retaining wall has to retain a 6 m high backfill of dry, cohesionless soil (γ = 19.0 kN/m^3 and $\phi = 33°$). The backfill has a surcharge angle of 8° while the back face of the wall has a batter angle of 10°. A line load of 50 kN/m runs parallel to the wall at a distance of 3 m from its top corner, the distance being measured along the surface of the backfill. Determine the magnitude of the resultant active thrust using Culmann's graphical method. No description of the procedure is necessary. However, indicate the direction in which the resultant thrust will act. [10]

4. A retaining wall with a vertical back has to retain a cohesionless backfill up to 3.8 m above GL. The properties of the backfill are:

γ_{sat} = 18.3 kN/m^3, c = 0, $\phi = 34°$

The depth of foundation of the wall is 1.2 m, while its top and bottom widths are 0.8 m and 2.6 m respectively. The backfill is sloped upwards at 10° to the horizontal. Check the stability of the wall against (i) sliding (ii) overturning (iii) base tension. [10]

5. A cantilever sheet pile has to retain a soil mass up to 5 m above the dredge line. The water table has been located at 1.2 m below the surface of the soil. The properties of the soils are as follows:

Above dredge level:

γ = 17.5 kN/m^3, γ_{sat} = 18.6 kN/m^3, $\phi = 32°$, $\phi' = 28°$

Below dredge level:

γ_{sat} = 20.3 kN/m^3, q_u = 63 kPa

Find out the required depth of embedment with respect to a factor of safety of 1.75. [10]

SECOND HALF

(Answer Q.**No. 6** and any **two** from the rest)

6. (a) Draw a flow chart for the planning and execution of a subsurface exploration programme.
(b) The results of a Standard Proctor tests are shown below.

Moisture content (%)	7.8	11.6	14.9	17.7	20.1	22.5
Wt. of soil and mould (gm)	3263.40	3523.28	3734.80	3852.90	3832.70	3765.10

The height and internal diameter of the mould are 12.6 cm and 10.1 cm respectively. The empty mould weighs 1950 gm. Plot the compaction curve and determine the optimum moisture content and the corresponding dry density of the soil. Also plot the zero air void line and 80 % saturation line. Given, specific gravity of soil solids = 2.69.

(c) Compute the factor of safety of an infinite slope of 32^0 inclination made in a sand deposit having an angle of internal friction of 38^0. [5+6+2=13]

7. (a) What are the differences between compaction and consolidation ?

(b) It is required to construct an embankment by compacting a soil excavated from nearby borrow areas. The optimum moisture content and the corresponding dry density of the soil were determine in the laboratory and were found to be 22.5 % and 16.6 kN / m^3 respectively. However, the natural moisture content and bulk density of the soil were 9 % and 17.8 kN /m^3 respectively. Find out the quantity of soil to be excavated and the quantity of water to be added to it, for every 100 m^3 of finished embankment.

(c) Determine the magnitudes of the compactive effort imparted to a soil during:
(i) Standard Proctor test; (ii) Modified Proctor tests. [3+5+3=11]

8. Write short notes on:
(a) Borehole log (b) Lime stabilized of soil (c) Standard penetration test. [3+3+5=11]

9. (a) Differentiate between:
(i) Auger boring and Wash boring (ii) Seismic refraction method and Electrical resistivity method for soil exploration.

(b) Determine the area ratios for the following soil samplers and comment on the nature of samples obtained in each of the samplers:

Sl. No.	Sampler	Outside dia (mm)	Inside dia (mm)
1	Core cutter	165	150
2	Split barrel	51	35
3	Seamless tube (Shelby)	51	48

[(4+4)+3=11]

10. (a) Define various factors of safety used in the analysis of stability of slopes.

(b) Explain various types of failures of finite slopes indicating the situations in which they are likely to occur.

(c) Describe the Swedish slip circle method of analysis for determining the factor of safety of finite slope for c-ϕ soils. [2+3+6=11]