Code No. : 5035/M

FACULTY OF ENGINEERING
B.E. 3/4 (Civil) II Semester (Main) Examination, May/June 2012
SOIL MECHANICS

Time : 3 Hours] [Max. Marks : 75

***Note**: Answer **all** questions of Part **A**, Answer **any five** questions from Part **B**.*

PART – A **(Marks 25)**

1. "For a given soil solids, the "Dry unit weight" is independent and "Unit weight of soil solids" is dependent on the arrangement of particles". Answer yes or no and justify your answer.
2. All other parameters remaining same, what is change in coefficient of permeability if viscosity and unit weight of the fluid are doubled ?
3. Sketch the moisture-density curve for same soil compacted as per IS light and IS Heavy compaction tests and comment on the effect of compaction effort on MDD, OMC.
4. "The unconfined compression test is suitable for cohesion-less soils only". Answer yes and no and justify your answer.
5. "Cohesion increases the active earth pressure and decreases the passive earth pressure". Answer yes or no and justify your answer ?
6. The in-situ void ratio of a soil mass is found to be 0.80. If its maximum and minimum voids ratios are 1.10 and 0.50 respectively, determine the relative density of the soil at site.
7. The flow net of an earthen dam consists of 4 flow channels and 8 potential drops. What is the discharge per meter length if k = 0.10 m/s, H = 10 m ?
8. The time required for a consolidating medium with single drainage to undergo 50% of its primary consolidation settlement was estimated as 32 years. All the conditions remaining same, estimate the time required if the medium has double drainage.
9. In a direct shear test, a clean dry Sand sample failed at a shear stress of 30 kPa when the normal stress was 50 kPa. Determine shear parameters of the soil.
10. Determine the depth of tension cracks developed in a Φ =0 soil having c=40 kPa and γ =20 kN/cum.

PART – B (5×10=50 Marks)

11. a) Derive the inter-relationship :

$r_d = \frac{(1-n_a)\, G.r_w}{1+W.G.}$ with standard notations. 5

b) The wet sieve analysis was conducted on a soil mass of dry weight = 600 grams. The results are as given below :

IS Sieve size in (mm)	4.75	2.00	0.425	0.075
Weight retained in grams	24	36	51	66

The liquid and plastic limit are found to be 64% and 48% respectively. Classify the soil as per IS : 1498-1970. 5

12. a) Explain "Capillarity in Soils" and derive the expression for capillary rise. 4

b) The soil profile at a site indicate that from GL up to 9 m a sandy strata is present, below which a practically impervious clay strata is present. A bore hole drilled in to the clayey strata indicated static water level in the bore well at 1.5 m below GL. The average properties of the sandy strata include G = 2.68, e = 0.55, γ sat = 19.5 kN/cum.

i) It is proposed to excavate a foundation trench in the sandy strata to a depth of 6 m below GL. Estimate the factor of safety against quick condition.

ii) Also determine the depth to which excavation can safely be carried out without the danger of quick sand. 6

13. a) What is "Relative Compaction" ? Explain the procedure to determine it. 5

b) Determine total primary consolidation settlement of the clay layer shown below due to an increment in effective stress of 180 kPa. 5

Ground level

(+) 0.00 m

SAND with γ = 19.50 kN/cum

GWT

(–) 2.00 m

FULLY SATURATED COMPRESSIBLE CLAY

γ sat = 21.50 kN/cum, LL = 80%, e0 = 1.10

(–) 8.00 m

SAND

14. a) Explain the procedure of "Triaxial Compression Test" for determination of shear parameters and compare its merits over Direct Shear Test. 5

    b) In a direct shear test, a cohesionless sample was failed at a shear stress of 45 kPa under a normal stress of 60 kPa. Sketch the Mohr's circle and determine (i) the shear parameters (ii) the principal stresses (iii) the orientation of the principal planes. 5

15. a) Describe the Active, Passive and at rest conditions of a back fill and derive expressions for coefficient of earth pressure for the respective conditions. 5

    b) A 9 m high retaining wall with a vertical face is supporting a back fill with horizontal top consisting of two types of soils. The water table is located at a depth of 5m below the top. The properties of soil from 0 to 3 m include c=0 kN/sqm; Φ =33°; γ =17 kN/cum and those for soil from 3m to 9m include c=0 kN/sqm; Φ =40°; γ =18.50 kN/cum, γ sub = 20.50 kN/cum. Plot the distribution of active and passive earth pressure and determine the magnitude and point of application of total active and passive earth pressure acting on the retaining wall. 5

16. a) Explain the "Swedish Slip Circle" method and derive the factor of safety for a slope in cohesive soils. 5

    b) It is proposed to construct a highway embankment using a c-Φ soil having c=20 kPa; Φ =10°, γ =17 kN/cum. Determine the critical height up to which the embankment can be built with an inclination of 29° with a factor of safety of 1.50. Given the Taylor's stability number for the conditions as 0.0737. 5

17. Write a detailed note on **any two** of the following : 10

    i) Methods to determine In-situ density

    ii) Field compaction methods

    iii) Application of Kozeny's parabola

    iv) Vane Shear Test.
