

FACULTY OF ENGINEERING

B.E. 3/4 (Civil) II Semester (Suppl.) Examination, December 2012

Subject: Soil Mechanics

Time: 3 Hours

Max.Marks: 75

Note : Answer all questions from Part A. Answer any Five questions from Part B.**PART – A** (10x2.5 = 25 Marks)

1. "The Pycnometer is ideal for determination of true specific gravity of cohesive soils". Answer yes or no and justify your answer.
2. In a given soil medium, the capillary rise of water was found to be 0.60 m. All other parameters remaining same, what will be the capillary rise if unit weight of the liquid is doubled?
3. The time required for 90% of consolidation of a clay medium with single drainage was found to be 24 years. What would have been the time if the medium had double drainage?
4. What is the effect of shape of particles on the shear strength of soils?
5. Describe base failure of a slope and explain when it is feasible.
6. The field dry density of ground at a site is found to be 18.20 kN/cum. Its dry density in loosest and densest states is found to be 16.40 kN/cum and 19.60 kN/cum respectively and its $G=2.65$. Determine the relative density of the soil at the site.
7. The coefficient of permeability associated with flow of a liquid through soil medium was found to be "k". All other parameters remaining the same, what will be the coefficient of permeability, if unit weight of the fluid is doubled and viscosity is halved?
8. It was proposed to compact soil in to a mould of 2250 cc at MDD corresponding to IS Heavy compaction test. All other parameters remaining the same, if only the number of blows have to be modified, how many blows should be applied to achieve MDD similar to that usually achieved in a standard 1000 cc mould?
9. In a direct shear test, a clean dry sand sample failed at a shear stress of 40 kPa when the normal stress was 60 kPa. Determine shear parameters of the soil.
10. A 6 m high wall with vertical face is retaining a back fill having $\phi = 36^\circ$. Determine the increment in total active earth pressure if a surcharge of 200 kPa is applied on the backfill.

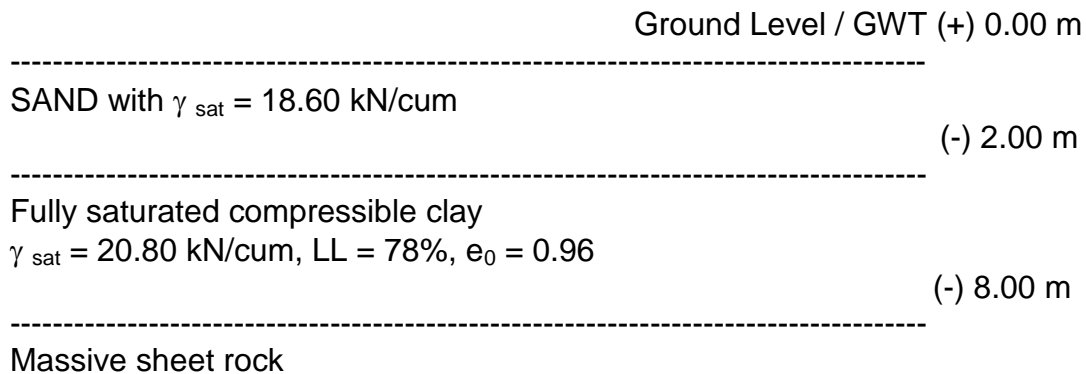
PART – B (5X10 = 50 Marks)

- 11.(a) From fundamentals, derive the following inter-relationship for soils

$$x = \frac{x_w [G + e S_r]}{1 + e} \text{ with standard notation.}$$

- (b) An un-disturbed soil sample is found to have a mass of 1680 g with total volume of 900 cc and at a degree of saturation of 58%. After oven drying the mass was found to be 1492 g. Determine the (i) In-situ moisture content (ii) True specific gravity (iii) the porosity (iv) Density at full saturation.
- 12.(a) Explain the procedure for determination of water content using Pycnometer and derive the concerned equation.
- (b) The details of a wet sieve analysis showed that, 82.40% of the total soil mass is finer than 75 micron meter size. The balance is predominantly sand. The liquid and plastic limits are 72% and 39% respectively. Classify the soil as per IS:1498-1970 and suggest suitable symbol for it.
- 13.(a) Write a note on permeability of soils and the factors affecting it. State any two field applications where in permeability plays an important role

- 13.(b) The soil profile at a site indicate that from GL up to 5m 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 was at 2m below GL. The average properties of the sandy strata include $G=2.70$, $e=0.6$, $\gamma_{sat} = 19 \text{ kN/cum}$. It is proposed to excavate a foundation trench in the sandy strata to a depth of 4m below GL. Estimate the factor of safety against quick condition.
- 14.(a) Differentiate the Indian Standard Light and Heavy compaction tests including their respective applications.
- (b) The soil profile at a site is as shown below. Determine total primary consolidation settlement of the clay layer if it is subjected to an increment in effective stress of 200 kPa. (5)



- 15.(a) Explain the "Vane Shear Test" and derive the expression for the shear strength based on its test procedure.
- (b) The record of a direct shear test are partially damaged. It is indicating that, a c-phi sample failed at a shear stress of 60 kPa when the normal stress was 90 kPa. The angle of shearing resistance was 36° . From this available data, determine:
- the value of cohesion
 - the shear stress at failure corresponding to a normal stress of 50 kPa.
 - for the test mentioned in (ii) determine the principal stresses and their orientation.
- 16.(a) Write a note on stability of earth retaining structures.
- (b) An embankment of a highway is proposed with a side slope of 1:1. The properties of the soil being used in the construction of slope include $c = 30 \text{ kPa}$; $\phi = 20^\circ$; Unit weight = 19 kN/cum. If Taylor stability number for these conditions is 0.062, determine:
- Factor of safety available for a slope of 10 m height
 - Critical height for the slope.
17. Write a note on any two of the following.
- Flow net and its applications
 - Field compaction quality control
 - Unconfined compression test
 - Coulomb's Wedge Theory
