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Code No.: 31005 S

**VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**  
**B.E. (Civil Engg.) III Year I-Semester Supplementary Examinations, May/June-2017**

**Soil Mechanics**

Time: 3 hours

Max. Marks: 70

Note: Answer ALL questions in Part-A and any FIVE from Part-B

**Part-A (10 × 2 = 20 Marks)**

1. Differentiate between percentage air voids and air content.
2. 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.
3. Differentiate between seepage velocity and actual velocity, what is the relation between them?
4. What is Darcy’s law? What are its limitations?
5. Explain the effect of gradation on compaction characteristics.
6. Define consolidation process and state necessary conditions for consolidation to take place.
7. Differentiate a UU test with CD test. Which of these provide effective shear parameters?
8. State the equation that governs the Vane shear test and explain the terms involved.
9. Define factor of safety with respect to friction.
10. Determine the un-supported depth of excavation in a pure cohesive soil with unconfined compressive strength of 100kPa.

**Part-B (5 × 10 = 50 Marks)**  
**(All bits carry equal marks)**

11. a) From the fundamentals, Derive the interrelationship between specific gravity, percentage air voids, water content and dry unit weight.  
 b) The following data was recorded in a core cutter method at a site. Empty weight of core sampler = 150gm, weight of core + in-situ moist soil = 3220gm, volume of sampler = 945cc, in-situ moisture content = 9.6%, specific gravity of solids = 2.64, Determine i) Void ratio ii) Degree of saturation iii) Dry density iv) Saturation density v) Density index if maximum and minimum void ratios are 1.10 and 0.21.
12. a) What is the effect of surcharge and the capillary action on the effective stress?  
 b) A sand deposit consists of two layers. The top layer is 2.5m thick ( $\rho = 1709.67\text{kg/m}^3$ ) and the bottom layer is 3.5m thick ( $\rho_{\text{sat}} = 2064.52\text{kg/m}^3$ ). The water table is at a depth of 3.5m from the surface and the zone of capillary saturation is 1m above the water table. Draw the diagrams, showing the variation of total, neutral and effective stresses.
13. a) What is “relative compaction”? Explain the procedure to determine it.  
 b) The time required to reach 60% consolidation for a sample 1cm thick tested in consolidometer under conditions of double drainage was found to be 35 seconds. Determine the time required for a layer 10m thick to reach the same degree of consolidation, if it has drainage only on one side.



14. a) Explain the basic differences between a box shear test and a tri-axial shear test.  
 b) The following results were obtained from a consolidated-undrained test on a normally consolidated clay. Plot the strength envelope in terms of total stresses and effective stresses and determine the strength parameters.

Sample no.	Cell Pressure (kN/m <sup>2</sup> )	Deviatoric Stress (kN/m <sup>2</sup> )	Pore water Pressure (kN/m <sup>2</sup> )
1	250	152	120
2	500	300	250
3	750	455	350

15. a) What are different types of earth pressures? Give examples.  
 b) A 9m high retaining wall with a vertical face is supporting a backfill 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 3m include  $c = 0$ ,  $\phi = 33^\circ$ ,  $\gamma = 17\text{kN/m}^3$  and those for soil from 3m to 9m include  $c = 0$ ,  $\phi = 40^\circ$ ,  $\gamma = 18.5\text{kN/m}^3$ ,  $\gamma_{\text{sub}} = 20.5\text{kN/m}^3$ . Plot the distribution of active earth pressure and determine the magnitude and point of application of total active earth pressure acting on the retaining wall.
16. a) Explain "Capillarity in Soils" and derive the expression for capillary rise.  
 b) Determine the neutral and effective stress at a depth of 16m below the ground level for the following conditions. Water table is 3m below ground level,  $G = 2.68$ ,  $e = 0.72$ , average water content of the soil above water table is 8%.
17. Write short notes on any *two* of the following:  
 a) California bearing ratio  
 b) Factors affecting shear strength of cohesionless soils  
 c) Rankine's earth pressure theory.

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