

B.Tech III Year II Semester (R13) Supplementary Examinations December 2016

**GEOTECHNICAL ENGINEERING - I**

(Civil Engineering)

Time: 3 hours

Max. Marks: 70

**PART - A**

(Compulsory Question)

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- 1 Answer the following: (10 X 02 = 20 Marks)
- What is meant by weathering of rocks? Explain different types of weathering.
  - Explain briefly about consistency limits.
  - Write a short note on Darcy's law.
  - Differentiate the terms:
    - Total stress.
    - Effective stress.
    - Neutral stress.
  - Explain about uses of flow net.
  - What are the assumptions made by Boussinesq theory?
  - What is the difference between compaction and consolidation?
  - Define the terms:
    - Coefficient of compressibility.
    - Coefficient of volume changes.
  - Mention the three drainage conditions adopted in shear tests, to simulate field conditions.
  - If the unconfined compressive strength was found to be  $300 \text{ kN/m}^2$ , estimate the cohesive strength in case of saturated plastic clay soils.

**PART - B**

(Answer all five units, 5 X 10 = 50 Marks)

**UNIT - I**

- 2 (a) Describe briefly different types of soil structures.
- (b) A partially saturated soil sample has natural water content of 15% and bulk unit weight of  $20 \text{ kN/m}^3$ . Compute the degree of saturation, void ratio, and porosity if the specific gravity of soils is 2.7.

**OR**

- 3 (a) What are the different types of clay minerals? Explain in detail.
- (b) Laboratory sieve analysis was conducted on a soil sample using a complete set of standard IS sieves. Out of 500 gms of soil used in the test, 200 g was retained on IS 600  $\mu$  sieve, 250 g was retained on IS 500  $\mu$  sieve and the remaining 50 g was retained on IS 425  $\mu$  sieve. Calculate coefficient of uniformity and classify the soil.

**UNIT - II**

- 4 (a) State the factors effecting permeability of soil.
- (b) A soil profile consists of a top layer of sand 3 m thick and  $\gamma = 17 \text{ kN/m}^3$ , an intermediate clayey silt layer 2 m thick and  $\gamma_{sat} = 15 \text{ kN/m}^3$  and a bottom layer of gravel 4 m thick and  $\gamma_{sat} = 19 \text{ kN/m}^3$ . The water table is at the top clayey silt layer. Determine the effective stress at various levels.
- OR**
- 5 (a) What is quick sand condition and derive the relationship for critical hydraulic gradient of sandy soil?
- (b) A falling head permeability test was carried out on a silty clay using a standard permeameter having sample of 12.7 cm long. Diameter of the sample and the stand pipe were 10 cm and 1.0 cm respectively. The water level in the stand pipe was observed to fall from 80 cm to 50 cm in 15 minutes. Determine the co-efficient of permeability of the soil and height of water level in the stand pipe after another 15 minutes.

**UNIT - III**

- 6 (a) Explain briefly about Newmark's influence chart and Westergaard's equation.  
 (b) What is meant by contact pressure and how it varies for different types of subgrades?

**OR**

- 7 (a) What are the factors effecting compaction?  
 (b) A Cohesive soil yields a maximum dry density of 1.8 g/cc, at OMC of 16% during a standard proctor test. If the value of G is 2.65, what is the degree of saturation, void ratio, air content, % air voids? What is maximum dry density it can be further compacted to above OMC?

**UNIT - IV**

- 8 (a) Explain the terms normally consolidated and over consolidated soils.  
 (b) A normally consolidated clay layer 2 m thick is sandwiched between two sand layers. The average overburden stress at the middle of clay layer can be taken as 160 kN/m<sup>2</sup>. Due to construction of a structure there is an increase in effective vertical stress of 40 kN/m<sup>2</sup> at the middle of clay layer. The liquid limit of clay layer is 60% and the initial void ratio is 0.9. Estimate the primary settlement.

**OR**

- 9 A building constructed on a compressible layer with doubled drainage settles by 80 mm in 4 yrs. The final settlement is expected to be about 300 mm.

U%: 60%    65%    70%

Tv: 0.29    0.35    0.403

- (a) The settlement that would occur in 9 yrs, will be.  
 (b) The time required to settle by 210 mm will be.  
 (c) The total settlement in 25 yrs will be.

**UNIT - V**

- 10 (a) What are the merits and demerits of direct shear test?  
 (b) Derive a relationship between the principal stresses at failure using Mohr-Coulomb failure criterion.

**OR**

- 11 Undrained tests were conducted on a saturated clay soil, The following are the consolidated results.

| Cell pressure<br>$\sigma_3$ (kN/m <sup>2</sup> ) | Deviator stress<br>$\sigma_d$ (kN/m <sup>2</sup> ) | Pore water pressure<br>$U$ (kN/m <sup>2</sup> ) |
|--|--|---|
| 150  | 102  | 80  |
| 300  | 200  | 164   |
| 450  | 304  | 264   |
| 600  | 405  | 325   |

Determine the effective stress strength parameters  $c'$  and  $\phi'$  by Mohr circle method and modified strength envelop method also.

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