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Reg No.: \_\_\_\_\_

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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FOURTH SEMESTER B.TECH DEGREE EXAMINATION, JULY 2017**

**Course Code: CE208**

**Course Name: GEOTECHNICAL ENGINEERING I (CE)**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions. Each carries 15 marks.*

- 1
  - a) What are the major soil deposits of India? (5)
  - b) Derive the relationship between dry density,  $\gamma_d$  and Bulk density,  $\gamma$  of soil. (5)
  - c) A moist soil sample of soil has a mass of 700 g and a volume of 200 cc at a water content of 10 %. Determine the Void ratio, Degree of Saturation and Percentage air voids Also determine the water content at which the soil gets fully saturated without any increase in volume (5)
- 2
  - a) What is a gradation curve? Sketch the gradation curves for Well graded and Gap graded soils? (4)
  - b) A soil sample consisting of particles of size ranging from 0.1 mm to 0.01mm, is put on the surface of still water tank 6 m deep. Calculate the time of settlement of the coarsest and finest particles of the sample to the bottom of the tank. Specific gravity of soil = 2.66, Viscosity of water = 0.008 poise. (5)
  - c) Explain the IS classification of soils. (6)
- 3
  - a) Define the following terms: - (4)
    - i) Activity
    - ii) Thixotropy
  - b) The Liquid limit of a soil sample is 46 % and Plastic limit is 27%. Classify the soil using a Plasticity chart. (5)
  - c) The Atterberg limits of a soil sample are LL= 52 %, PL = 33% and SL = 17%. If the specimen of the soil shrinks from a volume of 11.5 cc at Liquid limit to 6.2 cc when it is oven dried. Calculate: - (6)
    - i) Shrinkage ratio
    - ii) specific gravity of soil solids

**PART B**

*Answer any two full questions. Each carries 15 marks.*

- 4
  - a) State Darcy's law and explain the validity of the law (4)
  - b) Find the average horizontal and vertical permeabilities of a soil mass made up of three horizontal layers. The first and second layer have same thickness of 0.6 m each and third layer is 0.8 m thick. The coefficient of permeability of first, second and third layer are  $2 \times 10^{-4}$  cm/s,  $2.5 \times 10^{-5}$  cm/s and  $1.2 \times 10^{-4}$  cm/s respectively. (5)
  - c) Explain Mohr Coulomb failure criteria. Also draw the failure envelope for: - (6)
    - i) Pure sand
    - ii) Pure clay
- 5
  - a) What is UU and CD tests? (4)
  - b) What are the factors affecting Coefficient of Permeability? (5)

- c) In a deposit of sand 10 m thick, water table is 2m below ground surface. Above the water table, soil is saturated with capillary water. Saturated unit weight of sand is  $21 \text{ kN/m}^3$ . Plot the variation of Total stresses, Neutral stresses and Effective stresses over the depth of 10m. (6)
- 6 a) Explain the quick sand condition (5)
- b) The Triaxial tests conducted on four identical soil sample specimens gave the following results. (10)

Cell pressure in $\text{kN/m}^2$	100	150	200	250
Deviator stress in $\text{kN/m}^2$	300	420	515	607
Neutral stress in $\text{kN/m}^2$	6	12	14	16

Determine the shear parameters in terms of: -

- i) Total stresses                      ii) Effective stresses

### PART C

*Answer any two full questions. Each carries 20 marks.*

- 7 a) Define (5)
- i) Normally consolidated clay      ii) Over consolidated clay
- b) A clay layer 4m thick is sandwiched between layer of sand at top and impermeable strata at bottom. Calculate the time taken by clay layer to reach 40 % consolidation, if coefficient of consolidation is  $2 \times 10^{-4} \text{ cm/s}$ . (5)
- c) Explain the Friction circle method for slope stability analysis. (10)
- 8 a) What are the different types of slope failure? (5)
- b) What is meant by control of compaction (5)
- c) A saturated clay sample of height 25mm, cross sectional area  $50 \text{ cm}^2$  was subjected to a consolidation test and the results are as follows. Height of solids = 14.25mm. Final water content = 25%. Find the void ratio at various load increments by Height of solids method. (10)

Pressure in $\text{kN/m}^2$	0	10	20	40	80	160	320	640	0
Dial reading	490	482	470	431	390	343	295	249	350

- 9 a) A clay stratum 2m thick is subjected to an overburden pressure of  $150 \text{ kN/m}^2$ . Estimate the probable settlement of the clay layer if effective pressure at centre of clay layer is expected to increase to  $345 \text{ kN/m}^2$ . The slope of e- log p curve is 0.09. The initial void ratio is 1.12. (5)
- b) What are the uses of Stability number and Stability charts? (5)
- c) Explain about the standard proctor test. (10)

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