53 (CE 403) GTEN

2015

GEOTECHNICAL ENGINEERING

Paper : CE 403

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions out of seven.*

1. *(a)* Define the following terms : 2×5=10

   (i) Void ratio

   (ii) Porosity

   (iii) Degree of saturation

   (iv) Bulk density

   (v) Unit weight

(b) Explain the grain size distribution curves for well graded, uniformly graded and gap graded soils. What is coefficient of uniformity and coefficient of curvature? 6+4=10

2. (a) Explain the Atterberg's limit for soils. Why there is no volume change happened in soil below shrinkage limit? 7+3=10

(b) How soil is classified based on their plasticity index value? Explain. 5

(c) The dry density of a sand with porosity of 0·387 is $1600\,kg/m^3$. Find the void ratio of the soil and specific gravity of the soil solids

Take, $\gamma_w = 1000\,kg/m^3$ 5

3. (a) Explain the unified soil classification system and Indian standard soil classification system. 5+5=10

(b) What are the basic structural units present in the illite, kaolinite and montmorillonite mineral? Explain. 10

4. *(a)* State the difference between compaction and consolidation of soils. Explain the effect of particle structure of a soil on a standard proctor compaction curve at wet of optimum moisture content and at dry optimum moisture content. 5+5=10

(b) Explain the different factors effecting compaction of soils. What is zero air void line in compaction curve ? 8+2=10

5. *(a)* What is stress history of soil ? Explain the Casagrande construction technique for determining preconsolidation stress. 5+5=10

(b) Explain the Mohr-Coulomb failure criteria for determining the shear-stress of a soil on failure plane. Draw the stress strain curve for the following cases : 5+5=10

(i) Non-linear elastic material

(ii) Elastic-Plastic material

(iii) Rigid plastic material

6. (a) Explain the stress-strain curve and volume change characteristics curve of clays and sand for a consolidated drained (CD) test. 5+5=10

(b) Explain the face failure, toe failure and base failure for a finite slope. 5

(c) What is active and passive earth pressure of soil? Derive the expression for earth pressure at rest condition for a plane strain case. 5

7. (a) What is Darcy's law of fluid flow? Explain the different factors effecting permeability of soil. 2+8=10

(b) Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is $200 kN/m^2$ and the pore water pressure is $80 kN/m^2$. The effective stress shear strength parameters for the soil are :

$C' = 16 kN/m^2$ and $\phi' = 30°$ 5

(c) What is quick sand condition? Determine the expression for critical hydraulic gradient at quick sand condition. 2+3=5
