BCE-046

DIPLOMA IN CIVIL ENGINEERING DCLEC (G)

Term-End Examination

December, 2013

BCE-046 : SOIL MECHANICS AND FOUNDATION ENGINEERING

Time : 2 hours   *Maximum Marks : 70*

Note : Question No.1 is compulsory. Attempt any four more questions out of question number 2 to 8. All questions carry equal marks.

1. **Choose the correct alternative :**   7x2=14

    (a) The soils which have been transported by wind are known as :

         (i)   alluvial soils   (ii)   aeolian soils

         (iii) lacustrine soils   (iv)   marine soils

    (b) Relative density (Dv) can be expressed as :

         (i) $\dfrac{e_{max} - e_{nat}}{e_{max} - e_{min}}$ (ii) $\dfrac{e_{max} + e_{nat}}{e_{max} - e_{min}}$

         (iii) $\dfrac{e_{max}}{e_{max} - e_{min}}$ (iv) $\dfrac{e_{nat}}{e_{max} - e_{min}}$

(c) The variable head permeability test is used for :
    (i)   impervious soils
    (ii)   bentonite
    (iii) pervious soils
    (iv) none of the above

(d) The method used for investigation of lateral variation of soil type is known as :
    (i)   Seismic refraction method
    (ii)   Electrical resistivity method
    (iii) Resistivity Profiling
    (iv) Resistivity sounding

(e) Consolidated - Drained test is also known as :
    (i)   quick test   (ii)   slow test
    (iii) rapid test   (iv) strength test

(f) Nc, Nq and Nr are :
    (i)   Shear strength factors
    (ii)   Negative skin factors
    (iii) Standard penetration factors
    (iv) Bearing capacity factors

(g) A foundation is shallow if :
    (i) $D \leq B$ (ii) $D \geq B$
    (iii) $D = 2B$ (iv) $D = 4B$

2. (a) Using phase relationships, show that,   **7**

$$n = \frac{e}{1 + e}$$

where n = porosity, e = voids ratio

(b) The bulk density of a soil sample is   **7** 15 kN/m^3. Its specific gravity (G) is 2.70 and water content is 12%. Calculate :
    (i)   Dry unit weight
    (ii)   Voids ratio
    (iii) Porosity, and
    (iv) Degree of saturation
Assume $\gamma_w = 10$ kN/m^3

3. (a) Explain determination of liquid limit of a soil.   7

   (b) The natural dry density of a sand deposit is 20 kN/m^3. Laboratory tests give the maximum dry density as 21 kN/m^3 and minimum dry density as 19 kN/m^3. Find the relative density.   7

4. (a) Explain the constant head permeability test for measurement of coefficient of permeability in laboratory.   7

   (b) Determine the total, neutral and effective stresses at a depth of 10m below the ground surface for the following conditions :   7

   (i) Water table is 2m below the ground surface

   (ii) Unit weight of water = 10 kN/m^3

   (iii) Unit weight of the soil above the water table = 20 kN/m^3

   (iv) Saturated unit weight of soil below the water table = 22 kN/m^3

5. (a) Write salient features of Mohr-Coulomb failure theory.   7

   (b) A vane, 150mm in diameter and 200mm in height, was pressed into soft dry in a bore hole. Torque was applied and gradually increased till the failure took place. Determine the torque applied when the underained shear strength of soil is 25000 N/mm^2.   7

6. (a) Describe the effect of compaction effort on compaction. **7**

   (b) Explain how various properties of cohesive soils can be affected by disturbance of soil samples. **7**

7. (a) Describe the effect of type of soil on ultimate bearing capacity of soil for various types of footings. **7**

   (b) A square of footing of size 2.5m × 2.5m is built in a sandy soil of unit weight 17 kN/m^3 and having angle of shearing resistance of 35°. The depth of base of footing is 1.2m below the ground surface. Calculate the safe load that can be carried by a footing with a factor of safety of 3 against shear failure. Assume that the soil fails by general shear failure. Use Ferzaghi's analysis. The bearing capacity factors at 35° are : **7**

   $Nc = 57.8$

   $Nq = 41.4$ and

   $Nr = 42.4$

8. (a) Explain the various types of shallow foundations. **7**

   (b) Discuss the settlement analysis of a pile group inclay. **7**