Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH(CE-OLD)/SEM-5/CE-501/2012-13

2012
SOIL MECHANICS-I

*Time Allotted :* 3 Hours   *Full Marks :* 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

    i) A flow net is drawn for a weir. The total head loss is 6 m and no. of potential drops is 10 and the depth of flow path for the last square is 1 m. The exit gradient is

        a)   1   b)   0·6

        c)   1·6   d)   0·4.

    ii) The hydraulic head that would produce a quick condition in a sand stratum of thickness 1·7 m, specific gravity 2·68 and void ratio 0·61 is equal to

        a)   2·01 m   b)   1·04 m

        c)   3·06 m   d)   1·08 m.

    iii) Which of the following parameters have no influence on permeability of soil ?

        a)   Void ratio   b)   Degree of saturation

        c)   Pressure head   d)   Grain size.

    iv) Influence factor for line load at a point vertically below the line load at a depth Z is

        a)   0·637   b)   0·583

        c)   0·693   d)   0·525.

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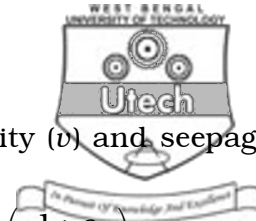
v) The relation between discharge velocity (v) and seepage velocity (v_s) is given by

a) $v_s = \left(\dfrac{e}{1+e} \right) v$

b) $v_s = \left(\dfrac{1+e}{e} \right) v$

c) $v_s = e.v$

d) $v_s = (1+e) v$.

vi) When the natural state of cohesionless soil is in its loosest form then the density index is

a) 0

b) 1

c) 2

d) None of these.

vii) If the consistency index of a soil exceeds unity the soil is in

a) Solid state

b) Semi solid state

c) Plastic state

d) Liquid state.

viii) The field density of a natural soil deposit or of a compacted soil can be determined by

a) sand replacement method

b) core cutter method

c) water displacement method

d) any of these.

ix) The ratio of the volume of voids to the total volume of the soil mass is known as

a) voids ratio

b) porosity

c) percentage air voids

d) none of these.

x) Composite correction for sedimentation analysis by hydrometer is

a) always positive

b) always negative

c) positive or negative

d) None of these.

xi) Sedimentation analysis is required when soil fraction finer than

a) 60 μ

b) 65 μ

c) 75 μ

d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.   3 × 5 = 15

2. a) Define total pressure, effective pressure and pore water pressure.
   b) What do you understand by quick sand condition ? 3 + 2
3. a) State the factors affecting permeability.
   b) What is Newmark's influence chart ?   2 + 3
4. Derive the relation between void ratio (*e*), water content (*w*), specific gravity (*g*) and degree of saturation (*S*).

5. An undisturbed soil sample has a volume of $100 \, cm^3$ and mass of 190 gm. On oven drying for 24 hours, the mass is reduced to 160 gm. If the specific gravity is 2·68, determine the water content, voids ratio and degree of saturation of the soil.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

6. a) What are the assumptions of the Laplace equation ?
   b) What are the properties of flownet ?
   c) Explain application of flownet in the determination of seepage.   4 + 4 + 7
7. a) In stress distribution in soil, state Boussinesq's assumptions. Where they differ from Westergaard's ?
   b) Explain the concept of pressure bulb.
   c) A 1000 kN load is uniformly distributed on an area 2 m × 3 m. Determine the approximate average vertical streets at 3m depth using 2 : 1 dispersion.   5 + 6 + 4
8. a) A clay layer 4·66 m thick rests beneath a deposit of submerged sand 8·20 m thick. The top of the sand is located 3·52 m below the surface of a lake. The

   saturated unit weight of the sand is 19·72 kN/m^3 and

   of the clay is 18·56 kN/m^3.

   Compute :
   (i) the total pressure
   (ii) pore water pressure
   (iii) effective pressure at mid height of clay layer.

b) Determine the height of capillary rise of water above the ground table in a homogeneous bed of sand having an effective size of 0·12 mm. The moisture content of the soil below the ground water table was found to be 25%.

Take G = 2·67 and C = 0·5 cm^2 and soil is fully saturated. 10 + 5

9. a) A natural soil deposit has a bulk unit weight of 18·44 kN/m^3 and water content of 6%. Calculate the amount required to be added to 1 cubic meter of soil to raise the water content to 16%. Assume the voids ratio to remains constant. What will be the degree of saturation ? Assume any data if necessary.

b) 50 gms of oven dried soil sample is taken for hydrometer test. The hydrometer reading 30 min after the commencement of test is 24·5. The effective depth found from calibration curve is 10·7 cm. The meniscus correction is found to be + 0·5 and composite correction as – 2·50 at the test temperature of 30° C. Calculate the smallest particle size which would have settled during the interval of 30 min and the percentage of particles finer than the size specific gravity of particles is 2·65 and viscosity of water is 0·01 poise. 8 + 7

10. a) What is the difference between the following ?

(i) Porosity and void ratio.

(ii) Saturated unit weight and submerged unit weight.

(iii) Specific gravity of soil solids and mass specific gravity ?

b) A cube of dried clay having sides 4 cm long has a mass of 110 gm. The same cube of soil, when saturated at unchanged volume has mass of 135 gm. Draw the soil element showing the volumes and weights of the constituents and determines the specific gravity of soil solids and the voids ratio. 9 + 6