B. E. Third Semester (Civil Engineering) / SoE – 2014 – 15 Examination

Course Code : CV 1203 / CV 203 Course Name : Geotechnical Engineering – I

Time : 3 Hours] [Max. Marks : 60

Instructions to Candidates :—

(1) All questions are compulsory.
(2) All questions carry marks as indicated.
(3) Due credit will be given to neatness and adequate dimensions.
(4) Assume suitable data wherever necessary.

1. (A) (A1) The mass of a chunk of moist soil is 15 kg, and its volume is 0.001 m^3. After drying in an oven, the mass reduces to 11.5 kg. Determine the water content, the density of moist soil, the dry density, void ratio, porosity, and the degree of saturation. Take G – 2.70. 4(CO1,2)

(A2) A sample has dry unit weight of 2.00 g / cc, moisture content of 10% and specific gravity is 2.68. Determine void ratio and saturated unit weight. 4(CO1,2)

(A3) Derive both the relationship between n and e as follows.

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

2(CO1)

OR

(B) (B1) Derive the following relationships between γ_{sat}, G and e. 4(CO1,2)

(B2) Write in detail about following soils,

(a) Sand (b) Gravel (c) Organic silt (d) Bentonite. 4(CO1)

(B3) Explain difference between residual and transported soil. 2(CO1)

2. (A) (A1) A soil has liquid limit of 25% and flow Index of 12.5% if the plastic limit is 15% determine the plasticity Index and toughness index. If the water content in its natural condition in field is 20% find liquidity index and relative consistency. 4(CO1,2)

(A2) Explain in detail about IS soil classification. 4(CO1,2)

(A3) Write in detail about sand bath method. 2(CO1,2)

OR

(B) (B1) Explain unified soil classification system (USCS). 4(CO1,2)

(B2) During a test for water content determination on a soil sample by pycnometer, the following observations were recorded.

(1) Mass of wet soil sample = 1000 gm

(2) Mass of pycometer with soil and filled with water = 2000 gm

(3) Mass of pycnometer filled with water only = 1480 gm

(4) Specific gravity of solids = 2.67

Determine the water content. 4(CO1,2)

(B3) Write down detail note on particle size distribution curve with focus on D_{10} and D_{30}. What is Cu and Cc ? 2(CO1,2)

3. (A) (A1) A horizontal stratified soil deposit consists of three uniform layers of thickness 4 , 8 and 10 m respectively. The permeabilities of this layer are 7×10^{-4} cm / s 45×10^{-4} cm / s , 5×10^{-4} cm / s, find the effective average permeability of the deposits in horizontal and vertical directions. 4(CO1,2)

(A2) Derive the relationship between discharge velocity (V) and the seepage Velocity (Vs) for a soil with void ratio (e). 4(CO1,2)

(A3) Derive the expression for coefficient of permeability in falling head test. 2(CO1,2)

OR

(B) (B1) Explain 'Quicksand condition' Give the expression for critical hydraulic gradient. 4(CO1,2)

(B2) Calculate the co – efficient of permeability of soil sample, 6 cm in height and 50 sq. cm. in cross sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. On oven drying, the test specimen has mass of 499 g. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test. 4(CO1,2)

(B3) Derive formula for constant head permeability test. 2(CO1,2)

4. (A) (A1) Explain Isobar diagram with an example for σ_z = 75%Q. 4(CO3)

(A2) A point load of 6 tonnes acts on the surface of ground, calculate vertical pressure due to this load at depth of 2 m at 4 m horizontally away from the axis of loading. 4(CO3)

(A3) Determine Vertical stress developed due to both loads at horizontal plane, 4 m below plane of loading, When two colums 4 m apart transfer point load of 10 tonnes and 20 tonnes on a semi – infinite soil surface. 2(CO3)

OR

(B) (B1) A point load of 175 KN acts on the surface of ground, calculate vertical pressure due to this load at depth of

(1) 2 m at 1 m horizontally away from the axis of loading.

(2) 2 m and just below the axis of loading. 4(CO3)

(B2) Derive Bossinesq's equation for vertical stress and shear stress due to point load. 4(CO3)

(B3) Explain point load method. 2(CO3)

5. (A) (A1) Derive Terzaghi's 1 – D Consolidation Theory. 4(CO4)

(A2) Following observations were made in a standard proctor test :—

Trial No	Mass of wet soil (Kg)	Water content (%)
1	1.70	7.7
2	1.89	11.5
3	2.03	14.6
4	1.99	17.5
5	1.96	19.7
6	1.92	21.2

Volume of mould = 945 cc , G = 2.67. Determine OMC and MDD. 4(CO4)

(A3) A light compaction tests gives maximum dry density of $20.5\,kN/m^3$ and O. M. C. = 35%. What is the degree of saturation and void ratio of maximum dry density, if specific gravity is 3.0 ? 2(CO4)

OR

(B) (B1) Explain the factors affecting compaction in detail. 4(CO4)

(B2) Explain primary and secondary consolidation. 4(CO4)

(B3) What is the difference between Standard and Modified Compaction test ? (minimum 4 points) 2(CO4)

6. (A) (A1) Derive the relation between major and minor principal stresses. 4(CO5)

(A2) Explain unconsolidated undrainted test. 4(CO5)

(A3) Draw and explain the failure envelope for sand and $c-\Phi$ soil. 2(CO5)

OR

(B) (B1) Derive the co – relationship between cohesion (c) unconfined compressive strength (q_u). 4(CO5)

(B2) Unconfined compressive test is conducted on saturated clay specimen 40 mm in diameter and 90 mm in length measured on its sides. The specimens have cone ends and its length between the picess of cones is 80 mm. The Specimen fails under an axial load of 460 N with axial deformation of 10 mm. Calculate Unconfined compressive strength of clay. 4(CO5)

(B3) Explain merits and demerits of UCS test. 2(CO5)