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.
(5) Retain the construction Lines.
(6) Illustrate your answers wherever necessary with the help of neat sketches.

1. (A) (A1) Establish the expression for bulk unit weight for soil in terms of specific gravity, void ratio and degree of saturation, with the help of Three–phase diagram. 4(CO1,2)

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

(A3) Explain field of Geotechnical engineer in construction industry. 2(CO1)

OR

(B) (B1) Derive the following relationship 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(CO1,2)

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

2. (A) (A1) Describe the sand replacement method. 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) Enlist different methods to determine water content, explain any one of them. 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 pycnometer 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) Explain unified soil classification system (USCS). 2(CO1,2)

3. (A) (A1) Derive and explain Darcy's law. 4(CO1,2)

(A2) Explain Factors affecting permeability of soil. 4(CO1,2)

(A3) Derive the expression for coefficient of permeability in failing 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.m. 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) A water tank is supported by a ring foundation having outer diameter of 11 m and inner diameter of 8.0 m. The ring foundation transmits uniform load intensity of 180 KN/m². Compute the vertical stress induced at a depth of 4 m. below the centre of ring foundation using Boussinesq analysis. 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 columns 4 m apart transfer point load of 10 tonnes and 20 tonnes on a semi–infinite soil surface. 2(CO3)

OR

(B) (B1) Explain Isobar diagram with an example for σ_z = 75%Q. 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) A laboratory compaction test on soil having specific gravity equal to 2.70 gave a maximum dry density 1.84 gm/cm³ and a water content of 18 percent. Determine the degree of saturation, air content and percentage air voids at the maximum dry density. What would be theoretical maximum dry density corresponding to zero air voids at the optimum water content ? 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) Derive Terzaghi's 1–D Consolidation Theory. 4(CO4)

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

6. (A) (A1) The specimen of clean, dry, cohesionless sand is tested in shear box and the soil failed at a shear stress of 45 kN/m^2 when the normal load on the specimen was 55 kN/m^2.
Determine:

(a) The angle of shearing resistance.

(b) The principal stress during failure.

(c) The directions of the principal planes with respect to the direction of the plane of shearing. 4(CO5)

(A2) Derive the relation between major and minor principal stresses. 4(CO5)

(A3) Draw and explain the failure envelope for sand and c–Φ soil. 2(CO5)

OR

(B) (B1) Explain Vane shear test. 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 pices 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)