S - 2603

Seat No.	

Total No. of Pages : 4

T.E. Civil Engineering) (Part - I) (Semester - V) Examination, December - 2015

GEOTECHNICAL ENGINEERING - I (New)

Sub. Code : 66238

Day and Date : Tuesday, 15 - 12 - 2015 **Total Marks : 100**

Time : 02.30 p.m. to 05.30 p.m.

Instructions: 1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**

SECTION - I

Q1) a) With the help of a phase diagram define the following: **[4]**

i) Void ratio;

ii) Porosity;

iii) Water content;

iv) Air content.

b) With usual notations derive the relationship: Se = WG **[6]**

c) Determine the degree of saturation and porosity of 18 kN/m^3 and water content of 18%. If the soil gets saturated, calculate the saturated unit weight content of soil before and after saturation? Take G = 2.62. **[7]**

OR

c) In a liquid limit test specimens of certain sample of clay following readings are obtained: **[7]**

WaterContent%	31.93	27.62	25.51	23.30
No. of blows	5	16	23	42

The plastic limit of clay is 13% natural water content 18%. Determine liquid limit, plasticity index, liquidity index, relative consistency and flow index.

P.T.O.

Q2) a) State the important factors that affect the permeability of a soil **[8]**

b) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5 m, 1 m and 2.5 m and having the coefficients of permeability of 3×10^{-2} mm/sec. 3×10^{-5} mm/sec and 4×10^{-2} mm/sec. Assume the layers are isotropic **[9]**

OR

b) The discharge of water collected from a constant head permeameter in a period of 15 minutes is 500 ml. The internal diameter of the permeameter is 5 cm and the measured difference in head between two gauging points 15 cm vertically apart is 40 cm. Calculate the coefficient of permeability.

If the dry weight of the 15 cm long sample is 4.86 N and the specific gravity of the solids is 2.65, calculate the seepage velocity. **[9]**

Q3) a) What are the various factors that affect the compaction of soil in the field? How will you measure compaction in the field? Describe a method with its limitations. **[8]**

b) In a consolidation test the following results have been obtained. When the load was changed from 50 kN/m^2 to 100 kN/m^2, the void ratio changed from 0.70 to 0.65. Determine the coefficient of volume decrease, m_v and the compression index Cc. **[8]**

OR

b) The following result refer to a standard compaction test: **[8]**

Water content W(%)	5	10	14	20	25
Bulk density (kN/m^3)	17.6	19.8	21.0	21.7	21.5

Determine the optimum moisture content and maximum dry density. Draw the zero air void curve and determine the degree of saturation and percentage air voids at maximum dry density. Take G = 2.70

SECTION – II

Q4) a) Using Boussinesq's expression, derive the expression for vertical stress at depth h under the centre of a circular area of radius a loaded uniformly with a load q at the surface of the mass of soil. **[9]**

b) A concentrated load of 22.5 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 15 meters and **[8]**

i) directly under the load, and

ii) at a horizontal distance of 7.5 metres. Use Boussinesq's equations

OR

b) A rectangular foundation, 2 m x 4 m, transmits a uniform pressure of 450 kN/m^2 to the underlying soil. Determine the vertical stress at a depth of 1 metre below the foundation at a point within the loaded area, 1 metre away from a short edge and 0.5 metre away from a long edge. Use Boussinesq's theory **[8]**

Q5) a) Explain the principle of the direct shear test. What are the advantages of this test? What are its limitations? **[8]**

b) Calculate the potential shear strength on a horizontal plane at a depth of 3 m below the surface in a formation of cohesionless soil when the water table is at a depth of 3.5 m. The degree of saturation may be taken as 0.5 on the average. Void ratio = 0.50; grain specific gravity = 2.70; angle of internal friction = 30°. What will be the modified value of shear strength if the water table reaches the ground surface? **[9]**

OR

b) A shear box test was carried out for a soil sample and the following data obtained: **[9]**

Trial Number	1	2	3
Normal pressure (kN/m^2)	50	150	250
Maximum shear stress (kN/m^2)	100	110	120

Find shear parameters. What would be the deviator stress at failure, if tri-axial test is carried out on same soil with udl pressure 150 *kN/m^2*

Q6) a) Write notes on: **[6]**

i) Rankine earth pressure theory,

ii) Coefficient of passive earth pressure.

b) A gravity retaining wall retains 12 m of a backfill, $\gamma = 17.7$ kN/m^3 $\varphi = 25°$ with a uniform horizontal surface. Assume the wall interface to be vertical, determine the magnitude and point of application of the total active pressure. If the water table is a height of 6 m, how far do the magnitude and the point of application of active pressure changed? **[10]**

OR

b) A smooth backed vertical wall is 6.3 m high and retains a soil with a bulk unit weight of 18 kN/m^3 and $\varphi = 18°$. The top of the soil is level with the top of the wall and is horizontal. If the soil surface carries a uniformly distributed load of 4.5 kN/m^2, determine the total active thrust on the wall per lineal metre of the wall and its point of application. **[10]**

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