Student Exam No:

# GANPAT UNIVERSITY
## B.TECH SEM V CIVIL ENGINEERING
## REGULAR EXAMINATION NOV - 2014
## 2CI503 GEOTECHNICAL ENGINEERING - I

**Time: 3 Hours** **Max Marks: 70**

**Instructions: - (1) Answer to the two sections must be written in separate answer books.**
**(2) Figures to the right indicate full marks.**
**(3) Assume suitable data if required.**

## SECTION - I

Q1(A) Define Permeability. State Darcy's law. Write a short note on validity of Darcy's law. **(4)**

(B) Explain the equivalent point load method. **(4)**

(C) Write Short note on the determination of pre-consolidation pressure by Casagrande method. **(4)**

**OR**

Q1(A) Briefly explain different types of slope failures? **(4)**

(B) How would you determine the stresses at a point due to a circular load? **(4)**

(C) Define: (i) Coefficient of Consolidation (ii) Compression index (iii) Over consolidated soil (iv) Coefficient of compressibility. **(4)**

Q2(A) Derive an expression for the vertical stress at a point due to a point load using Boussinesq's theory. **(6)**

(B) What do you mean by earth pressure at rest? Derive an equation for determining the magnitude of earth pressure at rest backfill. **(5)**

**OR**

Q2(A) Write down the assumptions for Rankine's theory? Derive the expressions for active earth pressure for both cohesive and cohesionless dry soil conditions. **(6)**

(B) What are the different factors of safety used in the stability of slopes? **(5)**

Q3(A) Two columns A and B are placed at 6m c/c distance. Column A transfers a load of 500 kN and Column B a load of 300kN. Determine the resultant vertical stress on a horizontal plane 2m below the ground surface at points vertically below the points A and B. (4)

(B) A long natural slope in c - $\phi$ soil is inclined at $10^0$ to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a slip plane had developed at a depth of 5m below the surface, determine the factor of safety. Take c = 10kN/m$^2$, $\phi = 25^0$ and $\gamma_{sat} = 20kN/m^3$ (4)

(C) In a laboratory a 2cm thick soil sample takes 25 minutes to reach 30% degree of consolidation. Find the time required for a 5m thick clay layer in the field to reach 40% consolidation. Assume double drainage in both the cases. (4)

## SECTION – II

Q4(A) Enlist various methods for determination of water content in a laboratory and explain alcohol method in detail. (4)

(B) Discuss the importance of Atterberg's limits in soil engineering. (4)

(C) A cylindrical specimen of a cohesive soil of 10 cm diameter and 20 cm length was prepared by compaction in a mould. If the wet mass of the specimen was 3.25 kg and its water content 15%, determine the dry density and the void ratio. If the specific gravity of the particles was 2.70, find the degree of saturation. (4)

**OR**

Q4(A) Write the different method for determining liquid limit in laboratory. Describe any one in detail. (4)

(B) Discuss field identification method for soil. (4)

(C) In order to find the relative density of sand a mould of volume 900 ml was used. When the sand was dynamically compacted in the mould, its mass was 1.90 kg, whereas when the sand was poured in loosely, its mass was 1.435 kg. If the in-situ density of the soil was 1.40 Mg/m$^3$, calculate the relative density. G=2.70 .Assume that the sand is saturated. (4)

Q5(A) Define the following term: (4)

(a)Bulk mass density (b) Dry mass density (c) Saturated mass density (d) Mass density of soil.

(B) An earthen embankment of $10^6$ $m^3$ volume is to be constructed with a soil having a void ratio of 0.80 after compaction. There are three borrow pits marked A, B, C, having soil with void ratio of 0.90, 1.50 and 1:80, respectively. The cost of excavation and transporting the soil is Rs. 0.25, Rs. 0.23 and Rs. 0.18 per $m^3$ respectively. Calculate the volume of soil to be excavated from each pit. Which borrow pit is the most economical? (G=2.65). (4)

(C) A soil has a dry density of 1.816 gm/ml in the natural condition. When 410 gm of the soil was poured in a vessel in a very loose state its volume was 290 ml. the same soil when vibrated and compacted was found to have a volume of 2415 ml. Determine the relative density. (3)

OR

Q5(A) Write a short notes on:- (I) Relative compaction (II) Compaction control (4)

(B) The following are the results of the standard compaction test perform on a sample of soil. (4)

| Water content (%) | 7.7 | 11.5 | 14.6 | 17.5 | 19.7 | 21.2 |
|---|---|---|---|---|---|---|
| Mass of wet soil(kg) | 1.7 | 1.89 | 2.03 | 1.99 | 1.96 | 1.92 |

If the volume of the mould used was 950 cc. and the specific gravity of soil grain was 2.65, make necessary calculation and plot the water content-dry density curve and obtain the optimum water content and the maximum dry density.

(C) Enlist various method of soil classification and explain particle size classification. (3)

Q6(A) A series of consolidated undrained triaxial test was conducted on oven-consolidated clay and the following results were obtained. (6)

| Sample no | Cell pressure($kN/m^2$) | Deviator stress($kN/m^2$) | Pore water pressure($kN/m^2$) |
|---|---|---|---|
| 1 | 115 | 500 | -80 |
| 2 | 240 | 610 | -20 |
| 3 | 490 | 840 | +130 |

Plot the strength envelope in term of effective stresses and hence determine the strength parameters. If the soil was preconsolidated to a pressure of 1000 $kN/m^2$, plot the variation of the pore pressure $A_f$ with the over consolidation ratio.

(B) Describe the triaxial test with sketch. What are the advantages of triaxial shear test over the direct shear test? (6)

**END OF PAPER**