JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- May-2023

COURSE CODE: 18B11CE411                                       MAX. MARKS: 35

COURSE NAME: Geotechnical Engineering

COURSE INSTRUCTORS: Prof. Ashok Kumar Gupta            MAX. TIME: 2 Hours

*Note: All questions are compulsory. Marks are indicated against each question in square brackets.*

1. What is a Mohr stress circle? Derive the relations behind its origin. (4)

2. A layer of soft clay is 6m thick and lies under a newly constructed building. The weight of sand overlying the clay layer is 250 kN/m$^2$ and the new construction increases the overburden by 100 kN/m$^2$. If the compression index is 0.5, compute the settlement. Water content of clay is 45% and specific gravity of grains 2.7. (5)

3. A standard Proctor compaction test was carried out on a soil with specific gravity of 2.77 compacted inside a 944 cm$^3$ container. Below is the data obtained during the test.

| w% | 5.02 | 8.81 | 11.25 | 13.05 | 14.4 | 19.25 |
|---|---|---|---|---|---|---|
| weight of soil, N | 16.02 | 17.52 | 19.54 | 20.22 | 20.29 | 19.29 |

i. Plot the compaction curve
ii. Determine the maximum dry density
iii. Determine the optimum moisture content
iv. Plot zero air void line
v. Compute the degree of saturation at optimum condition. (6)

4. A 2.5 cm thick clay sample was taken from the field for predicting the time of settlement for a proposed building which exerts a uniform pressure of 100 kN/m$^2$ over the clay stratum. The sample was loaded to 100 kN/m$^2$ and proper drainage was allowed from top and bottom. It was noticed that 50% of the consolidation occurred in 3 minutes. Determine the time required for same degree of consolidation under the building if it is standing over 6 m thick clay layer extending from ground surface and underlain by sand layer. (5)

5. A strata of normally consolidated clay of 3m thickness is drained on both sides with coefficient of permeability $5 \times 10^{-8}$ cm/sec and coefficient of volume compressibility as $125 \times 10^{-2}$ cm$^2$/kN. Find the ultimate compression of the strata due to a uniformly distributed load of 250 kN/m$^2$ and the time required for its 20% and 80% consolidation. (5)

6. A c-φ soil has an unconfined compressive strength of 120 kN/m$^2$. In a triaxial compression test, a specimen of the same soil when subjected to a cell pressure of 40 kN/m$^2$ failed under an additional stress of 160 kN/m$^2$. Determine the shear strength parameters of the soil and angle made by the failure plane in case of triaxial test. (Graph paper optional for Mohr's circle)　　　　　　　　　　　　　　　　(5)

7. A cylindrical sample of soil having cohesion of 80 kN/m$^2$ and angle of internal friction of 20° is subjected to a cell pressure of 100 kN/m$^2$. Determine
   (a)The maximum deviator stress at failure of sample
   (b) The angle made by failure plane with the axis of the sample.　　　　(5)