PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION – MAY/JUNE 2024

Semester : Semester IV - 2022
Course Code : CIV2015
Course Name : Geotechnical Engineering
Program : B.Tech. Civil Engineering

Date : Jun 14, 2024
Time : 9:30 AM - 12:30 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

Answer any 4 questions   **4*5M=20M**

1. Explain plasticity index, toughness index, consistency index, relative density and flow index of soil.
   (CO1) [Knowledge]

2. Soil exploration report from a site gave the following data. The moisture content of the soil is 12% and its bulk density is 1.6 g/cc. Find dry density, void ratio and degree of saturation of the soil. Assume specific gravity of soil as 2.6.
   (CO1) [Knowledge]

3. Explain flocculated and dispersed structure of soil with a neat sketch.
   (CO1) [Knowledge]

4. Draw the Moh'r coulomb failure envelope for pure cohesive soil, cohesion less soil and for the soil having both cohesion and angle of friction.
   (CO2) [Knowledge]

5. Explain shear strength of the soil and list the attributes for the development of shear strength parameters of the soil.
   (CO2) [Knowledge]

6. Workout the theoretical maximum dry density for a soil sample having specific gravity 2.7, optimum moisture content (omc) of 16%.
   (CO3) [Knowledge]

7. A cohesive soil yields a maximum dry density of 1.8g/cc at an optimum moisture content (omc) of 16% during a standard proctor compaction test. If the value of specific gravity is 2.65, what is the degree of saturation? What is the maximum dry density further it can be compacted to?
   (CO3) [Knowledge]

8. Explain what compaction is and list the various methods of compaction. Draw a typical compaction curve and state its salient features.

(CO3) [Knowledge]

PART B

Answer any 4 questions   4*10M=40M

9. A geometric arrangement of soil particles is known as structure of soil. Explain single grained and honeycomb structure of soil.

(CO1) [Comprehension]

10. Soil is a complex engineering material. Soil is a three phase system which consists of soil solids, air and water. Draw the three phase diagram of soil and establish the relationship between specific gravity (G), Degree of saturation (S), void ratio (e) and bulk unit weight (γ)

(CO1) [Comprehension]

11. Permeability is an engineering property of soil which allows the water to flow through it. Explain the factors affecting soil permeability.

(CO2) [Comprehension]

12. A series of direct shear tests were conducted on a soil at a construction site at Yelahanka and each test was carried out till the sample failed. The following results were obtained and are tabulated below. Determine cohesion and angle of shearing resistance for the soil sample.

sample No	Normal Stress (kN/m2)	Shear stress (kN/m2)
1	15	18
2	30	25
3	45	32

(CO2) [Comprehension]

13. Compaction is an artificial process of densification of soil where air is expelled from the soil. Explain the various factors affecting compaction.

(CO3) [Comprehension]

14. Consolidation is a natural process where water is expelled out, in this context explain preconsolidation pressure and also list the various steps involved to determine preconsolidation pressure.

(CO3) [Comprehension]

PART C

### Answer any 2 questions   2*20M=40M

15. A) Establish the relationship between saturated unit weights (γsat), specific gravity (G), unit weight of water (γw), and voids ratio (e).
B) A moist soil sample weighs 3.52 N. After drying in an oven, its weight is reduced to 2.9 N. The specific gravity of solids and the mass specific gravity are respectively 2.65 and 1.85. Determine the water content, void ratio, porosity and the degree of saturation. Take unit weight of water = 10 kN/m3

(CO1) [Application]

16. A compaction test has been conducted for a soil sample procured from a construction site at Jaynagar. The data obtained from experiment is shown below. Draw the compaction curve and find maximum dry density and optimum moisture content of the soil mass. Specific gravity G=2.7, volume of mould=950cc and mass of mould is 1000g also draw 100% saturation line (zero air void line) and 95% saturation line.

Water content (%)	12	14	16	18	20	22
Mass of wet soil + mould (g)	2685	2855	2915	2875	2875	2855

(CO2) [Application]

17. The diagram shown below is the profile of the ground at a construction site at Hebbal from soil investigation report. Calculate and plot the total stress, pore water pressure and effective stress diagram for the soil profile shown in Fig
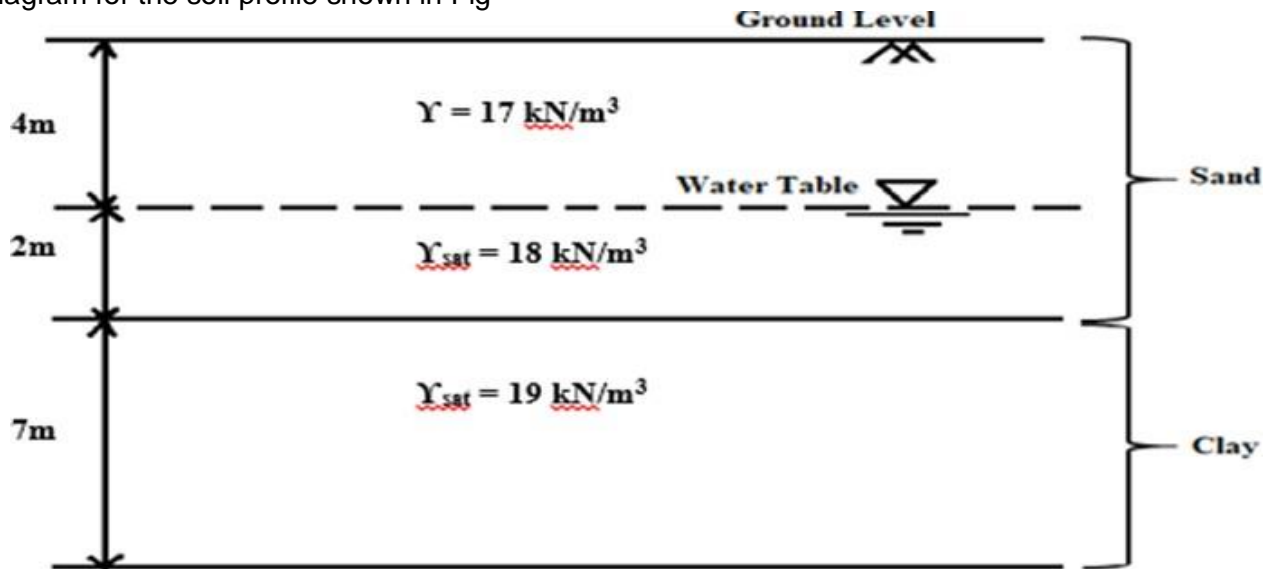
(CO2) [Application]

18. Compaction is an artificial process of densification of soil by mechanical means. The following table gives the data of compaction experiment conducted in the laboratory. Draw the compaction curve and find maximum dry density and optimum moisture content of the soil mass. Specific gravity G=2.7, volume of mould=950cc and mass of mould is 1000g also draw 100% saturation line (zero air void line) and 95% saturation line.

Water content (%)	12	14	16	18	20	22
Mass of wet soil + mould (g)	2680	2850	2910	2870	2870	2850

(CO3) [Application]