Question Paper Code	13602

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Civil Engineering

20CEPC403 - SOIL MECHANICS

Regulations - 2020

(Use of Graph sheet is permitted)

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K–Level	CO

1. If the water content of a fully saturated soil mass is 100%, then the voids ratio of the sample is   —   1   K1   CO1
   (a) Less than specific gravity of soil   (b) Equal to specific gravity of soil
   (c) Greater than specific gravity of soil   (d) Independent of specific gravity of soil

2. In hydrometer analysis for a soil mass   —   1   K1   CO1
   (a) Both meniscus correction and dispersing agent correction are additive
   (b) Both meniscus correction and dispersing agent correction are subtractive
   (c) Meniscus correction is additive and dispersing agent correction is subtractive
   (d) Meniscus correction is subtractive and dispersing agent correction is additive

3. The velocity of flow is proportional to _____ according to Darcy's law.   —   1   K1   CO2
   (a) Effective stress   (b) Hydraulic gradient   (c) Cohesion   (d) Adhesion

4. The co-efficient of transmissibility (T) of an aquifer is given by which of the following equation?   —   1   K1   CO2
   (a) T=b k   (b) T=b/k   (c) T=(bk)2   (d) T=k/b

5. The component τ_{xz} denotes _____   —   1   K1   CO3
   (a) Normal stress in x-direction
   (b) Normal stress perpendicular to y-axis
   (c) Normal acting perpendicular to x-axis
   (d) Shear stress acting perpendicular to y-axis

6. In Terzaghi's Theory of one-dimensional consolidation, the change in thickness of a layer during consolidation is _____   —   1   K1   CO3
   (a) Significant   (b) Insignificant   (c) Large   (d) Very large

7. The shear strength in cohesion less soil is due to _____   —   1   K1   CO4
   (a) Internal friction   (b) Cohesion
   (c) Inter granular friction   (d) Inter particle force

8. The normal stresses acting on planes of the soil are known as   —   1   K1   CO4
   (a) Major principal stresses   (b) Principal stresses
   (c) Minor principal stresses   (d) Principal planes

9. The value of pore pressure parameter, at failure for saturated clay is   —   1   K1   CO5
   (a) 1.2 to 2.5   (b) 2 to 3   (c) 0.3 to 0.7   (d) 0.7 to 1.3

10. Planar surface commonly occur in _____   —   1   K1   CO6
    (a) Embankment with the specific plane of weakness
    (b) All embankments
    (c) Soil deposit
    (d) Foundation of infinite depth

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **13602**

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11.	What is the function of A-line Chart in soil classification?	2	K1	CO1
12.	Derive the relation between void ratio and porosity.	2	K2	CO1
13.	List the various uses of flow net in engineering practices.	2	K1	CO2
14.	Differentiate seepage velocity and discharge velocity.	2	K2	CO2
15.	Define stress isobar.	2	K1	CO3
16.	Define pre consolidation pressure. In what ways its determination is important in soil engineering.	2	K1	CO3
17.	What is stress path?	2	K1	CO4
18.	Write down the Mohr – Coulomb failure envelope equation.	2	K1	CO4
19.	What are the advantages of Tri axial compression Test?	2	K1	CO5
20.	What is the effect of pore pressure on shear strength of soil?	2	K1	CO5
21.	What do you mean by tension crack?	2	K1	CO6
22.	Define stability number.	2	K1	CO6

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) A moist sample weighs 3.52 N. After oven drying 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 degree of saturation. — 11 K3 CO1

OR

   b) Soil is to be excavated from a borrow pit, which has a density of 1.75g/cc and water content of 12%. The specific gravity of soil particles is 2.7. The soil is compacted so that water content is 18% and the dry density is 1.65g/cc. For 1000m^3 of soil in fill, estimate (i) Quantity of soil to be excavated from the pit in m^3 (ii) Amount of water to be added. Also determine the void ratios of the soil in borrow pit and fill. — 11 K3 CO1

24. a) In a site reclamation project 2.6m of graded fill (unit weight = 22kN/m^3) were laid on compacted layers over an existing layer of silty clay (unit weight = 18kN/m^3) which was 3.2m thick. This was underlain by a 2.1m thick layer of gravel (unit weight = 20kN/m^3) Assuming that the water table remains at the surface of silty clay. Draw the effective stress profile for the following cases
   (i) Before the fill is placed.
   (ii) After the fill has been placed. — 11 K3 CO2

OR

   b) A falling head permeability test was carried out on a 15cm long sample of silty clay. The diameter of the sample and the stand pipe were 9.8cm and 0.75cm respectively. The water level in the stand pipe was observed to fall from 60cm to 45cm in 12 min.
   Determine:
   (i) Co-efficient of permeability of the soil.
   (ii) Height of water level in the stand pipe after another 20min.
   (iii) Time required for the water level to drop to 10cm. — 11 K3 CO2

25. a) A water tower is supported only on three pillars forming an equilateral triangle with 10m sides. The total weight of the tower is 1177.2kN. Calculate vertical stress 10m below the ground level at the following locations: *11 K3 CO3*
    (i) Under any one of the pillar.
    (ii) Under center of the two pillar.
    (iii) Under center of equilateral triangle.

OR

   b) A layer of clay 5m thick lies under a newly constructed building. The effective pressure due to overlying strata on the clay layer is $45kN/m^2$ and the weight of new construction increase the over burden by $5.5kN/m^2$. If the compression index of clay is 0.42, compute the settlement assuming the natural water content of the clay layer to be 43% and the specific gravity of its soil grains as 2.7. *11 K3 CO3*

26. a) The results of three consolidated un drained triaxial test on identical specimens of a particular soil are as follows. Determine the total and effective shear strength parameters. *11 K3 CO4*

Test number	1	2	3
Confining Pressure KN/m^2	200	300	400
Deviatoric stress at peak KN/m^2	245	315	385
Pore water pressure at peak KN/m^2	55	105	150

OR

   b) In a direct shear test on sand The normal stress is $200kN/m^2$ and shear stress at failure was $100 kN/m^2$. Determine the orientations of Principal planes and Failure plane. *11 K3 CO4*

27. a) Write down a step by step procedure for determination of cohesion of a given clayey soil by conducting unconfined compression tests. *11 K2 CO5*

OR

   b)(i) Explain about pore pressure parameters, uses and its applications. *7 K2 CO5*
   (ii) Discuss the merits and demerits of Vane shear test. *4 K2 CO5*

28. a) Derive from the first principle, the factor of safety of an infinite slope made of (i) Cohesion less soil and (ii) c-φ soil. *11 K2 CO6*

OR

   b) Explain briefly the procedure of friction circle method of analysis of soil stability with neat sketches. *11 K2 CO6*