

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), FEBRUARY 2022**CIVIL ENGINEERING (GEOMECHANICS)****(2021 Scheme)****Course Code :** 21GS103**Course Name:** Advanced Soil Mechanics**Max. Marks :** 60**Duration: 3 Hours****PART A***(Answer all questions. Each question carries 3 marks)*

1. Why are soils containing montmorillonite often expansive, whereas soils containing illite and/or kaolinite are not?
2. A person can walk comfortably on a sand beach adjacent to the sea, but not on the dry sand while walking towards the beach. Why?
3. Define preconsolidation pressure. Bring out the significance of estimating the preconsolidation pressure.
4. C and ϕ parameters of a soil are unique for that soil. State whether the statement is true or false. Substantiate your answer.
5. With neat sketch, bring out the effect of compactive effort on the compaction of soils.
6. Write a note on the thixotropy of clayey soils.
7. List any three advantages of preloading of soils.
8. Write a note on secondary consolidation settlement.

PART B*(Answer one full question from each module, each question carries 6 marks)***MODULE I**

9. a) Write short notes on:
 - (i) basic structural units of clay minerals (4)
 - (ii) hydrogen bonds
 - (iii) flocculated structure
- b) Isomorphous substitution affects the surface activity of a fine-grained soil. Comment on the statement. (2)

OR

- 10 As the geotechnical engineer on a project, you come across certain fine-grained soils in the site. You suspect that it contains kaolinite, halloysite, montmorillonite and quartz. Indicate the tests you would do to verify that these clay minerals are present. (6)

Indicate the reasons why you choose these tests and the criteria for distinguishing among the minerals.

MODULE II

11. a) Comment on the statement: Quick Sand is not a type of sand, but only a hydraulic condition. (2)
- b) Comment on the statement: The placement of a fill increases the effective stress at all elevations by an amount equal to the overburden pressure generated by the fill. Substantiate the statement using variation of σ , u and σ' with depth. (4)

OR

12. List the factors affecting permeability of soils. Discuss any four factors which you understand to be important. (6)

MODULE III

13. a) Differentiate between pore water pressure and excess pore water pressure. (1.5)
- b) A sample of normally consolidated clay is obtained from the field without causing any disturbance and without allowing its water content to change. In the field the sample was subjected to the following stresses. $\sigma = 350 \text{ kN/m}^2$, $u = 150 \text{ kN/m}^2$ and $\sigma' = 200 \text{ kN/m}^2$. The sample was placed on the desk in the laboratory.
- (a) What are the σ , u , σ' acting on it?
- (b) What is its over consolidation ratio (OCR)?
- The sample is placed in a consolidometer and a stress of 400 kN/m^2 is applied on it. Immediately on application of this stress
- (c) What are the σ , u , σ' acting on it?
- If water is not allowed to drain from the sample for 24 hours, at 24 hours
- (d) What are the σ , u , σ' acting on it?
- When complete consolidation has occurred,
- (e) What are the σ , u , σ' acting on it? (4.5)

OR

14. a) 50% of the consolidation at a site subjected to a load of 200 kN/m^2 occurred in 1.5 months. If the site had been loaded to 400 kN/m^2 , 50 % of the consolidation would have occurred in 3 months. State whether the given statement is true or false. Substantiate your answer. (2)
- b) In a consolidation test, the pressure on a sample was increased from 150 to 300 kN/m^2 . The void ratio after 100% consolidation under 150 kN/m^2 was 0.945 and that under 300 kN/m^2 was 0.812 . The co-efficient of permeability of the soil was $25 \times 10^{-7} \text{ cm/s}$ and the initial height of the sample was 20 mm . Determine (1.5)
- (i) the co efficient of consolidation. (1)
- (ii) the time taken for 90% consolidation of this clay, 6m thick in the field sandwiched between an impervious layer beneath and pervious layer on top.

- (iii) What would be the settlement of the above layer corresponding to 90% consolidation. (1.5)

MODULE IV

15. a) Write a note on stress path. (2)
 b) CU tests were carried out to failure on two identical specimens of silty clay with pore pressure measurements as given below:

Sl.No	Confining pressure (kPa)	Deviator stress (kPa)	Pore pressure (kPa)
1	100	150	40
2	200	220	75

(4)

Determine the shear strength parameters if

- (i) Construction is done at a faster rate
 (ii) Construction is done slowly

OR

16. a) The undrained shear strength of very soft clayey soil is to be determined in the field. Which test is most suitable? How is it performed? (3)
 b) Bring out the significance of critical void ratio. Draw typical plots to illustrate your answer. (3)

MODULE V

- 17 With neat sketches, illustrate the effect of compaction on the compressibility of clay soils (on the dry and wet side of optimum). (6)

OR

18. a) How is compaction controlled by the use of the Proctor's needle? (3)
 b) Following data was obtained during a field compaction control test:
 Weight of compacted soil excavated from pit = 510 g
 Bulk unit weight of sand = 1.46 g/cc
 Weight of sand required to fill the pit = 425 g
 Water content of soil = 10.5 %
 Compute the dry unit weight of the compacted fill. (3)

MODULE VI

19. a) A footing 5m x 5m in plan, transmits a pressure of 100 kN/m² on a cohesive soil having $E = 6 \times 10^4$ kN/m² and $\mu = 0.35$. Determine the immediate settlement of the footing at the centre, assuming it to be a) flexible, given Influence factor at the centre = 1.12 and b) rigid. (4)
 b) What are the aims of preloading? (2)

OR

20. A soil profile is shown in figure below. If a uniformly distributed load is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if : (6)

- The clay is normally consolidated
- The clay was subjected to a pre-consolidation pressure of 160kN/m^2 . Assume $C_r = C_c/6$
- What is the inference drawn from the results obtained in (a) and (b) above?


