

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

**FIRST SEMESTER M.TECH DEGREE EXAMINATION (Regular), DECEMBER 2022
GEOMECHANICS AND STRUCTURES****(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. 'Soils containing considerable amount of montmorillonite exhibits high swelling and shrinkage characteristics'. Substantiate this statement.
2. Ishitha mentioned in her presentation that quicksand condition is caused during liquefaction. Do you agree? Why?
3. Tarun was of the opinion that consolidation ceases after complete dissipation of excess pore water pressure from soil voids. Vinaya disagreed with him. If you are to support Vinaya, explain why she disagreed.
4. What gives soil its shear strength? Which test would you suggest to determine the shear strength of
 - a) marine clay
 - b) stiff clayGive reason for your suggestion.
5. What is meant by sensitivity of clay? Teena determined the sensitivity of two different clay samples – Sample A and Sample B to be 3 and 12 respectively. Help her to classify the samples and justify.
6. In which case do you expect more swelling – soil compacted at dry side of optimum or wet side of optimum? Give reason.
7. Varun's client is in a rush to construct a three storey building at a site where a layer of saturated clay is overlain by a layer of sand and underlain by an impermeable ground. Varun disagrees saying this will cause excessive settlement. Do you agree? If so, suggest a suitable technique to overcome this problem. Justify your suggestion.
8. Bring out the significance of settlement computation in geotechnical designs. Comment on the settlement of
 - a) granular soil
 - b) inorganic clay
 - c) peat

PART B

(Answer one full question from each module, each question carries 6 marks)

MODULE I

9. a) How do water molecules get attracted to the surface of clay particles? (3)
- b) 'Kaolinite is the strongest clay mineral'. Justify this statement with a neat sketch of the structure of kaolinite? (3)

OR

10. a) Swapna performed dilatancy test at a field of fine grained soil and suggested it is clay. Explain how she might have come to that conclusion? (2)
- b) Now, Swapna wishes to identify the clay mineral present in the soil sample. Suggest any 3 methods for the same. Explain any one method. (4)

MODULE II

11. a) Which are the tests to determine coefficient of permeability in a laboratory? Bring out the suitability of the tests in different soil types. (2)
- b) List the factors affecting permeability of a soil. Explain any two factors. (4)

OR

12. a) What do you understand about pore water pressure and effective stress? How does the direction of flow through a soil sample affect the effective stress at its bottom? (3)
- b) An upflow of 0.05 ml/s takes place through a sand sample with a coefficient of permeability 0.004 cm/s. the sample has a thickness of 300 mm and a cross sectional area of 5000 mm². Determine the effective stress at the bottom of the sample if its saturated unit weight is 20 kN/m³. (3)

MODULE III

13. a) What are the assumptions made in Terzaghi's one dimensional consolidation theory? (2)
- b) A laboratory sample of clay 2 cm thick took 15 minutes to achieve 60% consolidation under double drainage condition. What time will be required to attain the same degree of consolidation for a clay layer 3 m thick under the foundation of a building for a similar loading and drainage condition? (4)

OR

14. a) You performed an oedometer test on a clay sample of thickness 5 cm under double drainage condition. The time taken for 50% (4)

consolidation was 15 min. The following data were recorded.

σ' (kN/m ²)	120	140
e	1.50	1.44

Determine the following:

- (i) Coefficient of volume compressibility
 - (ii) Coefficient of consolidation
 - (iii) Compression index
 - (iv) Final settlement
- b) What relation will you use to determine the coefficient of permeability of clay sample from the above test result? Find the value of the same. (2)

MODULE IV

15. a) What are the advantages of performing a triaxial test rather than a direct shear test? (2)
- b) An undrained triaxial compression test was conducted on a sample of compacted clay. Pore water pressure was measured after the application of cell pressure and also at failure. The data recorded were:
- i) During consolidation stage:
 - Change in cell pressure was from 0 to 100 kN/m² (4)
 - Change in pore pressure was from -60 to +10 kN/m²
 - ii) During shearing stage:
 - Deviator stress at failure = 500 kN/m²
 - Pore pressure at failure = -70 kN/m²
- Find the pore pressure coefficients A and B.

OR

16. a) Suggest any 3 methods to determine the undrained shear strength of cohesive soils. (1.5)
- b) (i) Under what conditions would you prefer a vane shear test over an unconfined compression test?
- (ii) A vane 11.25 cm long and 7.5 cm in diameter was pressed into soft clay at the bottom of a borehole. Torque was applied to cause failure of the soil. If the shear strength of clay was found to be 37 kN/m², determine the torque applied? (4.5)

MODULE V

17. a) Write any three features of compaction in comparison to consolidation. (3)
- b) Explain the effect of compaction at the dry side and wet side of optimum on (3)

- (i) soil structure and
- (ii) compressibility

OR

18. a) Write a note on the salient features of a compaction curve using a neat figure? (3)
- b) List the different methods of compaction adopted in the field? How would you select the type of roller to be used? (3)

MODULE VI

19. A concrete footing 1.5 m x 1.5 m in size founded at a depth of 1 m in silty soil whose modulus of elasticity is 5.5×10^4 kPa. The footing is expected to transmit a unit pressure of 200 kN/m². Estimate the immediate settlement if the footing is (6)
- (i) rigid
 - (ii) flexible
- Assume any other data if necessary.

OR

20. Explain how stress path is used for settlement calculation. (6)
