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Pages: 3

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S4 (PT) (S) Examination January 2024 (2019 Scheme)

Course Code: CET204

Course Name: GEOTECHNICAL ENGINEERING – I

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1		Draw phase diagrams for fully saturated and dry soil.	3
2		Differentiate between specific gravity of soil solids and mass specific gravity.	3
3		Define i) relative consistency iii) relative density and iv) water plasticity ratio	3
4		List the factors affecting permeability.	3
5		Explain critical hydraulic gradient with the help of a neat sketch.	3
6		List different approximate methods for the determination of vertical stress below loaded areas.	3
7		Define the terms i) Coefficient of volume compressibility ii) compression index and iii) Degree of consolidation	3
8		Explain the terms i) relative compaction ii) placement water content iii) zero air voids line	3
9		Mention any three limitations of direct shear test.	3
10		Sketch different types of failures of finite slopes.	3

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11	a)	With the help of phase diagram establish the relation $n_a = \frac{e(1-S)}{1+e}$ where 'e' is the void ratio, n_a is the % air voids S is the degree of saturation.	6
	b)	A soil has a porosity of 40%, the specific gravity of solids of 2.65 and a water content of 12% determine the volume of water required to be added to 100m^3 of this soil for full saturation.	8
12	a)	Differentiate between flocculated and dispersed structure.	4
	b)	The soil in a borrow pit has a void ratio of 0.90. A fill-in-place volume of 20,000 m3 is to be constructed with an in-place dry density of 18.84	10

kN/m^3. If the owner of borrow area is to be compensated at Rs. 1.50 per cubic metre of excavation, determine the cost of compensation. Take G=2.7

Module -2

13	a)	List the assumptions made in the hydrometer analysis and the corrections in the observed readings.	6
	b)	A test for the determination of the liquid limit was carried out and the following results were obtained. Liquid limit is 72% and flow index 22. What will be the consistency index and the water plasticity ratio of the soil if the plastic limit and natural water content are 28% and 32% respectively? Also calculate the toughness index.	8
14	a)	Explain with a neat sketch well graded, poorly graded and gap graded soils.	6
	b)	A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeability of these layers are 8×10^{-4} cm/s, 52×10^{-4} cm/s, and 6×10^{-4} cm/s, and their thicknesses are 7, 3 and 10 m respectively. Find the ratio of effective average permeability of the deposit in the horizontal and vertical directions	8

Module -3

15	a)	Explain effective stress principle and define total stress, neutral stress and effective stress.	4
	b)	At a particular site lies a layer of fine sand 8 m thick below the ground surface and having a void ratio of 0.7. The water table is at a depth of 4 m below the ground surface. The average degree of saturation of the sand above the capillary fringe is 50%. The soil is saturated due to capillary action to a height of 2.0 m above the Ground water table level. Assuming $G_s = 2.65$, calculate the total and effective pressures at depths of 6 m and 3m below the ground surface.	10
16	a)	What is a Newmark's chart? Explain how this can be used for the determination of vertical pressure below loaded areas.	4
	b)	A strip footing 2m wide carries a uniform pressure of 250kN/m^2 on the surface of a deposit of sand. The water table is at the surface. The saturated unit weight of the sand is 20kN/m^3. Determine the effective vertical stress at a point 3m below the centre of the footing before and after the application of the pressure.	10

Module -4

17	a)	The average natural moisture content of a deposit is 40%; the specific gravity of the solid matter is 2.8, and the compression index *Cc is 0.36.* If the clay deposit	8

is 6.1 m thick drained on both sides, calculate the final consolidation settlement Given: original overburden pressure = 60 kN/m^2 and increase in pressure at the centre of clay layer = 30 kN/m^2

b) Sketch a flow curve and explain its uses. 6

18 a) Differentiate between compaction and consolidation. 6

b) The maximum dry density of a sample by the light compaction test is 17.8 kN/m^3 at an optimum water content of 15%. Find the percentage air voids and the degree of saturation. G=2.67. What would be the corresponding value of dry density on the zero air voids line at OMC. 8

Module -5

19 a) What is the shearing strength of soil along a horizontal plane at a depth of 4 m in a deposit of sand having the following properties: Angle of internal friction, ϕ = 35°, Dry unit weight, γ_d =17 kN/m^3, Specific gravity, Gs = 2.7. Assume the ground water table is at a depth of 2.5 m from the ground surface. Also find the change in shear strength when the water table rises to the ground surface. 8

b) Explain different types of shear test based on drainage condition. 6

20 a) Explain Taylor's stability chart and its uses. 4

b) Calculate the factor of safety with respect to cohesion, of a clay slope laid at 1 in 2 to a height of 10m. Cohesion is 25kN/m^2 and angle of internal friction 10^0 Υ=19kN/m^3. What will be the critical height of the slope in this soil? Given stability number = 0.064 10

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