Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree Examination June 2022 (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		Define Water Content, Degree of Saturation and Air Content	3
2		Explain Sensitivity and Thixotropy	3
3		Define Liquidity Index, Consistency Index and Flow Index	3
4		List the factors affecting permeability of soils	3
5		Explain Total Stress, Effective Stress and Neutral Stress	3
6		With a neat sketch explain isobar and pressure bulb	3
7		Explain Normally Consolidated, Over Consolidated and Under Consolidated Clays	3
8		Draw the Compaction Curve and explain Optimum Moisture Content and Maximum Dry Density	3
9		Explain Consolidated Undrained, Unconsolidated Undrained and Consolidated Drained Shear tests for soils	3
10		Explain the Rotational failure of slopes	3

PART B

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

Module -1

11	a)	Draw the three phase block diagram and derive the relation between Void Ratio, Specific Gravity, Water Content and Degree of Saturation	5
	b)	The field dry unit weight of a soil is 15.50 kN/m^3. The weight of dry soil filled in a container of volume 1 litre in its loosest state and densest state are 14N and 18N respectively. What is the density index of the soil? G =2.70	9
12	a)	Compare the engineering features of any three major soil deposits of India.	5
	b)	A partially saturated sample has a natural water content of 10% and bulk unit	9

weight of 17 kN/m^3. The specific gravity of solids is 2.67. Determine the void ratio and degree of saturation. What will be the Saturated unit weight of the sample?

Module -2

13 a) A clay has a liquid limit of 60% and shrinkage limit of 20%. If a specimen of this soil shrinks from a volume of 15000mm^3 at liquid limit to 9000 mm^3 at shrinkage limit determine the specific gravity of soil solids. 7

b) Sketch the plasticity chart used for classifying a fine-grained soil. 7
Classify the soil as per IS classification system
Percentage of soil finer than 75-micron sieve = 15%
Percentage of soil finer than 4.75 mm sieve = 73%
Liquid limit = 28%, Plasticity index = 12%

14 a) A soil sample in a variable head permeameter is 100mm in diameter and 120mm high. The permeability of the sample is known to be 3 x 10^{-3}mm/sec. If it is desired that the head in the stand pipe should fall from 550mm to 300mm in 200seconds, determine the diameter of the stand pipe to be used. 7

b) Determine the ratio of average coefficient of permeability in the horizontal to vertical direction for a deposit consists of three layers 2m, 1.5m and 4m and having coefficient of permeability 3.5x10^{-5} m/sec, 4.5x10^{-5} m/sec, 1.5x10^{-5} m/sec. 7

Module -3

15 a) Explain Quick Sand Condition 5

b) A soil profile consists of top layer of sand 3 m thickness having bulk unit weight 16kN/m^3, an intermediate layer of clay 3.5m thickness having saturated unit weight 20kN/m^3 and bottom layer of sand 5 m thickness having saturated unit weight of 18kN/m^3. The water table is observed at 3m below ground level. Determine the total stress, neutral stress and effective stress at top, bottom and interface of layers and plot the variation of these stresses with depth. 9

16 a) Determine the vertical stress intensity at a point 4 m below ground level and 1.5m away from the line of action of a vertical point load of 250kN acting on the ground surface by Boussinesq's equation 5

b) A water tank is supported on a circular ring type of foundation. The ring is of 1.5mwidth and its external diameter is 8m. Compute the vertical stress at 1.5m 9

depth beneath the centre of the foundation, if pressure on the foundation is 150kPa.

Module -4

17	a)	Explain the method of determination of pre-consolidation pressure on clay	5
	b)	In a soil profile, the top layer consists of sand up to 1.5m depth and is underlain by 3m thick normally consolidated clay. The water table is at 1m below ground level. The density of sand is 18kN/m^3 above the water table and 19kN/m^3 below the water table. The natural water content and specific gravity of clay are 30% and 2.70 respectively. The liquid limit of clay is 65%. Estimate the probable settlement of clay layer, if the pressure at mid-height of clay layer increases by 50kPa.	9
18	a)	Explain the Proctor Needle method of Field Compaction Control with neat sketches.	7
	b)	Distinguish the laboratory and field equipment needed for compaction in sandy and clayey soils.	7

Module -5

19	a)	In a drained triaxial compression test on dense sand the cell pressure was 200kPa and the deviator stress to cause failure was 550kPa. Calculate the angle of shearing resistance. Also find the angle made by the failure plane with respect to the major principal plane.	9
	b)	Compare the merits and demerits of a triaxial compression test	5
20	a)	Explain Friction Circle method of slope stability analysis	9
	b)	A slope is to be made in clay for which the cohesion is 25kN/m^2 and Φ=0. The density of soil is 18 kN/m^3. Find the maximum height of slope if the side slope is 1.5 to 1, and the factor of safety is to be 1.5. Take Taylor's stability number as 0.17.	5

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