Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP/S7PT) Examinations May/June 2026 (2019 Scheme)

Course Code: CET305
Course Name: GEOTECHNICAL ENGINEERING - II

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks)

		Marks
1	What is the difference between active earth pressure and passive earth pressure?	3
2	Name the two classical earth pressure theories and state one assumptions each	3
3	Why does the same building need a wider footing on soft clay than on dense sand?	3
4	What is Terzaghi's bearing capacity formula for a strip footing?	3
5	What is differential settlement? Discuss whether a differential settlement of 20 mm between two corners of a building can be harmful.	3
6	State the objectives of a plate load test and mention any two limitations.	3
7	What is negative skin friction in piles? Under what conditions does it occur?	3
8	What is meant by "group efficiency" of piles?	3
9	How do geophysical methods help in site investigation? Name any two such methods.	3
10	Name the corrections applied to the Standard Penetration Test (SPT) value and state their purpose.	3

PART B

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

Module -1

11	a)	A retaining wall of height 6 m retains a layered backfill: Top 2 m: dry sand, $\gamma = 16$ kN/m³, $\varphi = 30°$ Bottom 4 m: saturated clay, $\gamma_{sat} = 19$ kN/m³, $\varphi = 0°$, $c = 25$ kPa Water table is at the interface of the two layers. Using Rankine's theory: (a) Calculate the active earth pressure at the interface and at the base of the wall. (b) Draw the pressure distribution diagram.	7

(c) Find the total active thrust per meter length of wall.

b) Explain at-rest earth pressure and discuss the conditions under which active, passive and at-rest earth pressures develop in retaining structures with suitable sketches. 7

12 a) Sketch any 4 different types of shallow foundation. 4

b) A retaining wall 6 m high, vertical back, supports a saturated clay soil with a horizontal surface. The properties of the backfill are $\varphi = 0$, Cu = 35 kPa, $\Upsilon = 17$ kN/m^3. Assuming the back of the wall to be smooth, determine: 10

a) Depth of tension cracks

b) Critical depth of vertical cut

c) total active thrust against the wall and its point of application if cracks are not formed in the tension zone.

d) total active thrust against the wall and its point of application if cracks are formed in the tension zone.

Module -2

13 a) A square footing of size 2.5 m × 2.5 m is to be placed at a depth of 1.2 m in a sandy soil (c = 0). 10

Soil properties: $\gamma = 18$ kN/m^3, $\varphi = 36°$.

Terzaghi's bearing capacity factors: Nq = 47.2, Nγ = 50.0 (for φ=36°).

(a) Compute the ultimate bearing capacity assuming water table is at a great depth.

(b) If the water table rises to the ground surface, compute the new ultimate bearing capacity using $\gamma' = 10$ kN/m^3.

(c) Calculate the safe bearing capacity with a factor of safety of 3 when water table at a greater depth (a)

b) Write Terzaghi's bearing capacity equations for a circular footing and a square footing. 4

14 a) A strip footing is to be designed on a thick deposit of sand. The sand has an angle of internal friction of 28° and a cohesion intercept of 3 kN/m^2. The footing will be placed at a depth of 1.5 m below ground level. The groundwater table is located at the same depth (1.5 m below ground level). The dry unit weight of sand is 15 kN/m^3, and the saturated unit weight is 19 kN/m^3. The applied load on the foundation is 250 kN per meter length. A factor of safety of 2.5 is required. 10

The bearing capacity factors are: Nc=30,Nq=18, Nγ=25.

Take the unit weight of water as 10 kN/m³. Using Terzaghi's bearing capacity theory, determine the required width of the footing.

b) Differentiate between gross bearing pressure and net bearing pressure with suitable expressions. 4

Module -3

15 a) A plate load test was conducted on a sandy soil using a 30 cm square plate. The settlement of the plate was 5 mm at a pressure of 200 kPa. 10

(a) Estimate the settlement of a 2 m square footing carrying the same pressure using the appropriate formula for sand.

(b) What are two limitations of the plate load test?

(c) If the allowable settlement for the footing is 25 mm, is the footing safe?

b) Explain the conventional design procedure for a rigid raft foundation. 4

16 a) Explain the procedure of a plate load test. 4

b) Design a combined footing for two columns with loads of 3000kN & 5000kN. The centre-to-centre distance between two columns is 4.0 m. Columns are having sizes 0.6 m x 0.6 m. There is a restriction on the projection of the footing on both column sides by 0.2 m from the face of the columns. Take allowable soil pressure as 200 kN/m². 10

Module -4

17 a) A concrete pile of length 12 m and cross-section 0.4 m × 0.4 m is driven into clay. Hammer weight = 30 kN, drop height = 1.2 m, final set = 6 mm per blow. Use the modified Hiley formula (coefficient of restitution = 0.5, efficiency = 0.8, weight of pile = 24 kN). Calculate the ultimate load capacity of the pile. 8

b) Describe the I.S. static formulae for computing the bearing capacity of a single pile in clay and in sand. 6

18 a) A group of 9 piles of 600 mm diameter is arranged in a square pattern with centre-to-centre spacing of 1.3m. The piles are 11m long and are embedded in soft clay with cohesion of 40 kN/m². Adhesion factor is 0.6, and bearing resistance is neglected. Compare the individual and group criteria results & analyze the governing value for the study. 8

b) Determine the ultimate bearing capacity of soil along the length of a concrete pile of diameter 48 cm driven into sand of loose to medium density to a depth of 16 6

m. Take Nq = 17.5. Assume the water table is at a great depth. The following are the properties: Average unit weight of soil is 18 kN/m^2, the angle of internal friction of 32°, and lateral earth pressure coefficient of 1.6.

Also, determine the allowable load with a factor of safety of 2.6.

Module -5

19	a)	Explain the Seismic Refraction method of geophysical exploration.	8
	b)	List any 3 sampler parameters and explain their significance	6
20	a)	An SPT was conducted in a dense sand deposit at a depth of 22m, and a valuc of 48 was observed for N. The density of sand is 15 kN/m^3. What is the value of N corrected for overburden pressure?	6
	b)	The inside diameters of a sampling tube and that of a cutting edge are 70mm and 68mm, respectively, and outer diameters are 72mm and 74mm, respectively. Determine the inside clearance, outside clearance and area ratio of the sampler and comment on the results.	8

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