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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S,FE) (FT/WP) Examination May 2025 (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	Explain the term earth pressure at rest along with a practical example.	3
2	Excavation was being carried out for a foundation in a plastic clay with a unit weight of 22.5 kN/m^3. Failure occurred when a depth of 8.1 m was reached. What is the value of cohesion if the angle of internal friction is 0°.	3
3	Define (i) Gross pressure intensity (ii) Net ultimate bearing capacity (iii) Safe bearing capacity	3
4	Explain any 6 factors affecting bearing capacity of soil.	3
5	Explain floating foundation with principle.	3
6	Differentiate between total settlement and differential settlement.	3
7	Explain classification of piles based on mode of transfer of load.	3
8	Describe modified Hiley formula and explain each terms in the formula.	3
9	Mention the objectives of Site investigation.	3
10	Explain wash boring method with neat sketch.	3

PART B

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

Module -1

11	a)	A 6 m high retaining wall supports a two-layered backfill having the following characteristics. Top layer: cohesion = 10 kPa, angle of internal friction = 30^0, unit weight of soil = 18 kN/m^3, thickness = 3 m. Bottom layer: cohesion = 0, angle of internal friction = 41.8^0 , unit weight of soil = 19.2 kN/m^3. Determine the total active earth pressure and its location, if tension cracks are likely to develop in the field.	8
	b)	A retaining wall of 10 m height has sandy backfill with voids ratio of 0.65, angle of internal friction of 30° and a specific gravity of 2.65. The water table is at a depth of 3 m from the ground surface. Determine the magnitude and point of application of total active earth pressure.	6
12	a)	A retaining wall 8 m high with a smooth vertical back retains a clay backfill with angle of internal friction of 15°, cohesion of 15 kN/m^2 and unit weight of 18	6

kN/m^3. Calculate the total active thrust on the wall assuming that tension cracks may develop to full theoretical depth.

b) A retaining wall supports a backfill with the following properties: Upper layer: angle of internal friction = 30^0, unit weight = 17 kN/m^3 , thickness = 2 m. Lower layer: angle of internal friction = 35^0 , unit weight 19 kN/m^3 , thickness = 4 m. Find the total lateral earth pressure, if the retaining wall tends to move towards the backfill. 8

Module -2

13 a) A column, carrying a load of 750 kN, has to be supported by a square footing with its base at 1.5 m depth. What is the required size of footing which will provide a factor of safety of 3 against shear failure? c=10 kN/m^2 , $\phi=30^0$, γ=17 kN/m^3. Water table is at greater depth. Assume General Shear Failure. For $\phi=30^0$, N_c =37.2, N_q =22.5, N_γ =19.7. 8

b) Compute the safe bearing capacity of a continuous footing 1.8 m wide and located at a depth of 1.2 m below the ground level in a soil with unit weight of 20 kN/m^3, cohesion of 20 kN/m^2. Assume factor of safety as 2.5. What is the permissible load per metre run of the footing? Take N_c = 17.7, N_q = 7.4 and N_γ = 5. 6

14 a) A strip footing 1.5 m wide with its base at a depth of 1 m is resting on dry sand stratum. Take unit weight as 17 kN/m^3, saturated unit weight as 20 kN/m^3, cohesion = 0, N_q = 65.34 and N_γ = 77.2. Determine the ultimate bearing capacity of footing if the ground water is located at a depth of: i) 0.5 m below ground surface ii) 0.5 m below the base of the footing. 8

b) Design a strip footing to carry a load of 750 kN/m at a depth of 1.6 m in a soil having a unit weight of 18 kN/m^3 and shear parameters as c = 20 kN/m^2 and Angle of internal friction as 25^0 . Determine the width of footing using a factor of safety of 3 against shear failure. Take N_c = 25.1, N_q = 12.7 and N_γ = 9.7. 6

Module -3

15 a) Explain the conventional method for the design of raft foundation. 7

b) A trapezoidal footing is to be designed to support two square columns of 40 cm and 50 cm sides respectively. Columns are 6 m apart and safe bearing capacity of the soil is 200 kN/m^2. The bigger column carries a load of 2000 kN and smaller column carries a load of 1500 kN. Design a suitable size of the footing so that it does not extend beyond the face of the columns. 7

16 a) Explain and illustrate the procedure, uses and limitations of plate load test. 7

b) A trapezoidal footing is to be produced to support two square columns of 30 cm and 50 cm sides respectively. Columns are 6 m apart and safe bearing capacity of the soil is 400 kN/m^2. The bigger column carries 5000 kN and smaller 3000 kN. Design a suitable size of the footing so that it does not extend beyond the face of the columns. 7

Module -4

17 a) Illustrate construction details of well foundation. Mention the methods to rectify tilt and shift also. 7

b) A group of 9 piles arranged in a square pattern with diameter and length of each pile as 25 cm and 10 m respectively, is used as a foundation in soft clay deposit. Taking the unconfined compressive strength of clay as 120 kN/m^2 and pile spacing 100 cm c/c, find the safe load capacity of pile group. Assume factor of safety 3 and adhesion factor 0.9. 7

18 a) It is proposed to provide pile foundation for a heavy column, the pile group consist of 4 piles, placed at 2 m centre to centre forming a square pattern. The underground soil is clay, having cohesion at the surface as 60 kN/m^2 and at a depth of 10 m as 100 kN/m^2. Compute the allowable column load on pile cap, if the piles are circular having diameter 0.5 m each and length as 10 m. 7

b) Draw a neat sketch of IS pile load test setup. Explain the determination of safe load of pile from Load-settlement plot. 7

Module -5

19 a) The inside diameters of a sampling tube and that of a cutting edge are 68 mm and 66 mm respectively and outer diameters are 70 mm and 72 mm respectively. Determine the inside clearance, outside clearance and area ratio of the sampler. 6

b) Explain boring log and soil profile using neat sketch. 8

20 a) Explain disturbed and undisturbed sample. 6

b) Explain (i) Seismic refraction method and (ii) Electrical Resistivity method. Mention its applications 8

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