Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S8 (R,S) Examinations April 2026 (2019 Scheme)

Course Code: CET426
Course Name: ADVANCED FOUNDATION DESIGN

(Permit the students to use Brom's and IS charts for determination of lateral capacity of pile, chart for bearing capacity factors)

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		Explain the method of determining the bearing capacity of shallow foundations in c-ϕ soil layered soil.	(3)
2		Illustrate the general shear failure and local shear failure in soil and discuss the load determination method for the two cases.	(3)
3		Explain the influence of the method of pile installation and soil type on the spacing between piles in a group.	(3)
4		A reinforced concrete pile of size 30 x 30 cm and 10 m long is driven into coarse sand extending to great depth. The average total unit weight of the soil is 18 kN/m^3 and the average N value is 15. Determine the allowable load on the pile by static formula. Use FOS=2.5. The water table is close to the surface.	(3)
5		List the advantages of underreamed piles.	(3)
6		Mention any three design considerations for underreamed piles as per Indian Standards.	(3)
7		Sketch the deflection, soil reaction and bending moment diagram for short pile-free head in cohesive soils.	(3)
8		Write any three assumptions of IS 2911 method for laterally loaded piles.	(3)
9		Differentiate between the terms free and forced vibrations with examples.	(3)
10		List any three applications of sheet pile walls.	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	The footing 2 m x 2 m is located at a depth of 1.5 m in a sand deposit. Boring has	(9)

indicated that the average corrected N value at the site is 25. Water Table at a depth of 2m below the ground surface. Determine the net allowable bearing pressure for a factor of safety of 3 against shear failure and a permissible settlement of 25 mm. Use Teng's equation.

b) Explain the effect of the water table on the bearing capacity estimation for shallow foundations with neat sketches. (5)

OR

12 a) Compute percentage change in ultimate bearing capacity of a strip footing of width 1.5m when water table is lowered from 0.5 m below the ground level to 2.5 m below ground level. The footing is founded at a depth of 2m on a c-ϕ soil with c=10 kPa and ϕ=32º.γsat = 17kN/m^3. (10)

b) Discuss the equation given by Terzaghi for determining the ultimate bearing capacity of a shallow foundation. (4)

Module II

13 a) A concrete pile of 45 cm diameter is driven to a depth of 16 m through a layered system of sandy soil (c = 0). The following data are available. (9)

Top layer 1: Thickness = 8 m, γ_d = 16.5 kN/m^3, e = 0.60 and ϕ = 30°.

Layer 2: Thickness = 6 m, γ_d= 15.5 kN/m^3, e = 0.65 and ϕ = 35°.

Layer 3: Extends to a great depth, γ_d = 16.00 kN/m^3, e = 0.65 and ϕ= 38°.

Assume that value of δ in all layers of sand is equal to 0.75ϕ. The value of average K_s for each layer is equal to the passive earth pressure coefficient. The water table is at the ground level. Calculate Qu and Qa for FOS=2.5.

b) Illustrate the method of equivalent raft approach for computing the settlement of pile groups in clay. (5)

OR

14 a) Find the uplift capacity of the reinforced cement concrete pile shown in Figure 1. Unit weight of R.C.C. may be taken as 24 kN/m^3. (10)

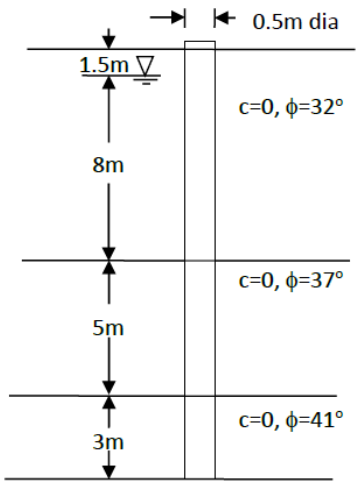

Figure 1

b) Discuss the equation used for computing the vertical load carrying capacity of a single pile in clay as per Indian Standards. (4)

Module III

15 a) The figure 2 shows a concrete drilled pier with a belled bottom. The details of the pile and the soil properties are given in the figure. Estimate the ultimate uplift load. Neglect conical shape of the belled portion in computing self-weight. (10)

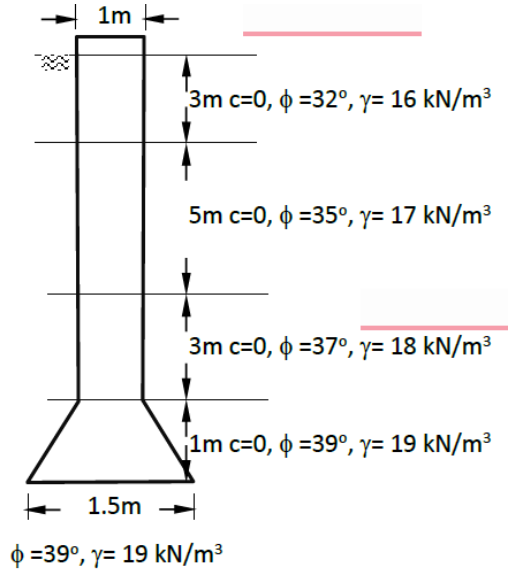

Figure 2

b) Explain the load transfer mechanism in the case of drilled piers with a figure. (4)

OR

16 a) Determine the safe load in bearing and uplift for the under reamed pile with the following data. α = 0.6, no. of bulbs = 3, bulb diameter = 1 m, stem diameter = 400 mm, average cohesion along the length of pile & at the tip = 100 kPa. (14)

Module IV

17 a) A steel pipe pile of 61 cm outside diameter with 2.5 cm wall thickness is driven into saturated cohesive soil to a depth of 20 m. The undrained cohesive strength of the soil is 85 kPa. Calculate the ultimate lateral resistance of the pile by Broms' method with the load applied at ground level. (10)

b) Explain the criteria used for classifying a pile as long or short as proposed by Brom. (4)

OR

18 a) A steel pipe pile with an outside diameter 61 cm and inside diameter 56 cm is driven into a medium dense sand under submerged conditions. The sand has a relative density of 60% and an angle of internal friction of 38°. Compute the ultimate lateral resistance of the pile by Brom's method. Assume that the yield resistance of the pile section is 23.45 x 10^6 kgcm. The submerged unit weight of the soil y_b =8.75 kN/m^3. (8)

b) A steel pipe pile of 61 cm outside diameter with a wall thickness of 2.5 cm is driven into loose sand *(Dr* = 30%) under submerged conditions to a depth of 20 m. The submerged unit weight of the soil is 8.75 kN/m^3 and the angle of internal friction is 33°. The *El* value of the pile is 4.35 x 1011 kg-cm^2 (4.35 x 10^2 MN-m^2). Compute the ground line deflection of the pile under a lateral load of 268 kN at ground level under a free head condition using Brom's method. The n_h value from for *Dr* = 30% is 6 MN/m^3 for a submerged condition. (6)

Module V

19 a) Explain the method of determining the depth of embedment of cantilever sheet pile wall in sandy soil with figure. (8)

b) An excavation of 4 m deep is to be carried out in a sand deposit and cantilever sheet pile walls are driven into the ground before excavation. The ground water table is located at 2 m from the top of the supporting soil, The bulk unit weight of the sand is 18 kN/m^3 above the water table and 21 kN/m^3 below the water table. The friction angle is 30º. The soils below the dredge line and below the water table have similar properties. Determine the required depth of embedment by using simplified method. (6)

OR

20	a)	Differentiate active and passive vibration isolation. What are the different control measures to be adopted for vibration isolation?	(6)
	b)	With neat sketches, explain the different types of machine foundations.	(8)

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