

B.CIVIL ENGG FOURTH YEAR SECOND SEMESTER. 2017 (OLD)(2nd Semester)**SUBJECT: ADVANCED FOUNDATION ENGINEERING****Time: Three hours****Full Marks : 100**

Use a separate Answer-Script for each part

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1. Answer All Questions
2. Assume reasonable values of data if it is not supplied.
3. No code. will be needed to answer the questions of this part

No. of Question		Marks
Q.1	A 3.50m wide vertical cut is to be made down to a depth of 13.0m below Ground level using struts and Diaphragm wall. The subsoil is soft clay of unit wt. $1.8t/m^3$ and undrained strength of $2.5t/m^2$. The first strut is placed at a depth of 2.0m and the subsequent struts at 4.0m interval. Horizontal spacing of strut is 3.0m. Find out the load on each strut and also check the factor of safety against bottom heave if there is a stiff clay layer beyond 16.0m depth. Take $N_c = 8$	15
Q.2 a)	Illustrate Ground Improvement techniques for non cohesive soil	5
b)	The subsoil profile at a site consists of soft grey silty clay with decomposed wood ($\gamma = 18 \text{ kN/m}^3, C_u = 16 \text{ kN/m}^2, C_c/1+e_0 = 0.16$) down to 10m below GL followed by stiff to very stiff layer of bluish to yellowish grey silty clay ($\gamma = 19.5 \text{ kN/m}^3, C_u = 8 \text{ kN/m}^2, C_c/1+e_0 = 0.11$). The ground water table is near the ground surface. A 22m diameter x 13.5m high steel oil storage tank is proposed to be built at the site with a 1m thick sand pad with projection of 1 m on each side at base of the tank. The side slope of sand pad is 1:1 Consider 1st stage preloading with sand ($\gamma = 20 \text{ kN/m}^3$) with a height of 3m preloading for ground improvement by sand drain. Find the need of ground improvement from bearing capacity consideration and settlement at tank centre for target degree of consolidation of 90%. Given that the ratio of increase of undrained shear strength of the clay to the increment of surcharge load is 0.25. Find also the expected undrained shear strength after this stage of preloading.	20
Q.3 a)	Illustrate different components of a well foundation with a neat sketch.	10
b)	The subsoil at the typical location of a pier of a major bridge consists of medium silty sand ($N = 11, \phi = 30^\circ$, weighted mean diameter = 0.8mm) down to 10m below bed level. This overlies a layer of highly weathered rock. <ol style="list-style-type: none"> i) Using Lacey's formula calculate the maximum scour depth. ii) Also estimate the net allowable bearing capacity of a well of 8m diameter. Given: Founding Level : 2.5 m below top of rock layer Max. flood discharge = 28000 m^3 per second Length of bridge = 850 m Submerged unit weight of soil and rock = 10 KN/m^3 For weathered rocks $C = 0, \phi = 35^\circ, [N_q = 32 \text{ and } N_\gamma = 33]$ Factor of safety = 3	10
Q.4 a)	A drilled pier was constructed in expansive soil. The water table was not	

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encountered. The details of the pier and soil are as follows:

Pier:

Shaft length = 10 m, (Depth of active zone=2m), diameter= 400mm

Soil:

Swelling pressure, = 300 kN/m², $C_u = 100 \text{ kN/m}^2$, SPT(N) = 25 blows per 30 cm, adhesion factor for unstable zone=1.0 and that for stable zone is 0.6

Determine:

- (a) Total uplift capacity
 - (b) Total resisting force due to surface friction
 - (c) Factor of safety without taking into account the dead load Q acting on the top of the pier
 - (d) Factor of safety with the dead load acting on the top of the pier and comment about the safety of the pier, if $Q = 100 \text{ kN}$ 10
- b) Illustrate a method of dewatering with a neat sketch for construction of a 4m deep cut in a silty clay layer 10
- Q.5a) What is coefficient of elastic uniform compression? How can you find damping factor from Block Vibration Test data? 10
- b) A block of size 1m x2m x1m is subjected to vertical vibration with resonance at a frequency of 25 cycles per second. The total weight of machine and oscillator is 65 kg. It is found that the force at a frequency of 15 cycles per second is 105 kg. Determine the coefficient of elastic uniform compression, amplitude at a frequency of 15cycles per second with zero damping and also that with damping factor of 25%. 10