

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018**

**Course Code: CE364**

**Course Name: ADVANCED FOUNDATION ENGINEERING**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

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|---|---|------|
| 1 | a) What are the different types of shallow foundations? (2)   | (2)  |
|   | b) A water tank foundation has a footing of size 6x5 m founded at a depth of 3 m below ground level in a medium dense sand stratum of great depth . The foundation is subjected to a vertical load at an eccentricity of 1m from the centreline along one of the axes. Estimate the ultimate load, $Q_{ult}$ , by IS code method. Adopt $C=0$ kPa, $\gamma=18.5$ kN/m <sup>3</sup> , $\phi=35^\circ$ , $N_r=33.3$ , $N_q=48.03$ . Water table is at a depth of 3.8m below the existing ground level.                        | (10) |
|   | c) Explain the effect of water table on foundation.   | (3)  |
| 2 | a) Explain the concept of allowable bearing pressure.   | (3)  |
|   | b) A square footing of 3x3m is transfers load at a depth of 2m below the ground comprising of cohesionless soil. The average corrected standard penetration test value $N_{cor}=15$ for the sand deposit. Find the allowable bearing pressure for a settlement of 25mm using Teng's correlation and Meyerhoff's correlation. Water table is at the base of the footing  | (8)  |
|   | c) List the different methods of analyses of raft foundations? Explain the concept of floating raft.  | (4)  |
| 3 | a) A square footing of 1.2mx1.2m size is placed 1m below the ground level that comprises of medium dense sand having a modulus of elasticity of 12000 kPa and Poisson's ratio of 0.32. Thickness of the stratum below the footing is 5m. Average net contact pressure of the footing is 180 kPa. Compute the immediate elastic settlement of the footing at its centre. Use Steinbrenners method. Take Steinbrenners Influence factors for the centre of the footing for the above conditions are $I_1=0.526$ , $I_2=0.058$ | (5)  |
|   | b) A square footing 2m x 2m size transfers a load of 800 kN to the bearing stratum at a depth of 1.5m below the existing ground level. Water table is at the ground   | (10) |

level. The subsoil comprises of a 12m thick layer of clay ( $G=2.65$ ,  $\gamma_{\text{sat}} = 1.6 \text{ kN/m}^3$ ). The clay layer has a natural water content of 60% and a liquid limit of 72% and is underlain by dense sand layer. Estimate the ultimate consolidation settlement.

### PART B

*Answer any two full questions, each carries 15 marks.*

- 4 a) Explain the classification of pile foundation based on various criteria (5)  
 b) A cylindrical reinforced cement concrete bored cast in-situ pile of 12m depth and 0.5m diameter is installed in a site comprising of layered strata. (10)

Layer No.	Depth range	Unit weight	angle of internal friction
1	0- 5m	16 kN/m <sup>3</sup>	28°
2	5-10m	17 kN/m <sup>3</sup>	33°
3	10 – 20m	18 kN/m <sup>3</sup>	40°

Compute the safe load carrying capacity of the pile assuming a factor of safety of 2.5. Ground water table is at a depth of 2.5m below the existing ground level. Take  $N_\gamma = 109$  and  $N_q = 120$  for  $\phi = 40^\circ$ .

- 5 a) A 40 cm diameter driven precast pile is installed to a depth of 12m in a site comprising of silty sand which extends to a great depth. The pile penetrates 3m into the bearing stratum which has an average penetration resistance value ( $N$  value) of 22. What is the unit point resistance of the pile? (3)  
 b) Explain how modified Hiley formula is used for the determination of the load carrying capacity of driven pile foundations. (4)  
 c) An under reamed pile with a single bulb was installed in a site comprising of uniform clay of  $c_u = 25 \text{ kPa}$ . The layer extends infinitely. The pile has a shaft diameter of 40 cm and bulb diameter of 80 cm and the shaft extends to a depth of 9m below the ground level. The under ream is provided at a depth of 8m below the existing ground level with the top and bottom surfaces of the bulb making an angle  $45^\circ$  with the horizontal. Ground water table is at a depth of 20m below the ground level. Compute the ultimate uplift capacity of the pile. (8)
- 6 a) List the different types of pile load tests conducted. (2)  
 b) Explain the determination of ultimate load from initial and routine pile load tests on single piles. (5)  
 c) Explain how cyclic pile load tests are performed. Explain the method of (8)

separation of skin friction and end bearing from cyclic pile load tests mentioning various steps involved and using sketch.

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) Explain the concept of negative skin friction (3)
- b) A square pile group of 9 piles (30 cm diameter spaced at 90 cm centre to centre) passes through a recently filled up soil of 5 m depth (unconfined compression strength is  $60 \text{ kN/m}^2$  and unit weight is  $15 \text{ kN/m}^3$ ). Compute the negative skin friction of the pile group (5)
- c) A group of 16 piles arranged in square pattern are placed in a clay deposit whose properties are  $\phi=0$ ,  $C_u=80 \text{ kN/m}^2$  and  $\alpha=0.6$ . The piles are 500 mm in diameter and 7 m long. Calculate the spacing of the pile group for maximum efficiency. Neglect end bearing. (7)
- 8 a) Give a neat sketch of the cross section of a typical well foundation. What are the different types of well foundations? (5)
- b) A 16 pile group of 40 cm diameter piles is arranged in a square pattern at a spacing of 1m centre to centre. The pile group is 9m deep and transfers a load of 2000kN. The pile group is installed in a 20m deep clay stratum ( $w_L=48\%$ ,  $w_n=40\%$ ,  $G=2.65$ ,  $\gamma_{\text{sat}}=15 \text{ kN/m}^3$ ) underlain by hard rock. Compute the ultimate consolidation settlement of the clay stratum. Use equivalent raft approach. (10)
- 9 a) List the different forces acting on well foundation. (4)
- b) A single tube circular well foundation of 3m diameter is installed to a depth of 7m below the scour level in granular soil. The corrected standard penetration value (N value) in the bearing stratum is 58. Estimate the allowable bearing pressure of the well foundation. (3)
- c) What are the precautions to be adopted for avoiding tilts and shifts during the sinking of well foundations? What are the methods of correcting tilts and shifts during well sinking? (8)

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