FOUNDATION ENGINEERING TEST 4

Number of Questions: 25 **Time: 60 min.**

Directions for questions 1 to 25: Select the correct alternative from the given choices.

1. For toe failure the depth factor D_F is
(A) < 1 (B) > 1
(C) $= 1$ (D) None of these

2. The maximum value of stability number is
(A) 0.261 (B) 0.281
(C) 0.241 (D) 0.291

3. Which of the following is true for General shear failure?
(A) $I_D < 20\%$ (B) $e > 0.75$
(C) $N > 30$ (D) $N < 5$

4. The ultimate bearing capacity (q_f) and net ultimate bearing capacity (q_{nf}) are connected by relation
(A) $q_{nf} = q_f + \gamma D$ (B) $q_f = q_{nf} + \gamma D$
(C) $q_f = q_{nf}/F + \gamma D$ (D) $q_f = (q_{nf} + \gamma D)/F$

5. The allowable settlement for isolated foundations as per in sand and hard clay is
(A) 75 mm (B) 50 mm
(C) 100 mm (D) 80 mm

6. The piles that are provided at an inclination, to resist lateral forces (or) inclined forces is known as
(A) Tension piles (B) Anchor piles
(C) Fender piles (D) Batter piles

7. If the actual observed value of standard penetration resistance N is greater than 15 in a fine sand layer below water table, then equivalent penetration resistance will be
(A) $15 + \frac{(N+15)}{2}$ (B) $15 + \frac{(N+15)}{2}$
(C) $15 + \frac{(N-15)}{2}$ (D) $15 + \frac{(15-N)}{2}$

8. Cantilever sheet pile is generally suitable for depths
(A) $d \le 5$ (B) $5 \le d \le 10$
(C) $d \ge 10$ (D) $d \ge 12$

9. Geotextiles are used for
(A) compacting loose soils
(B) reducing settlements
(C) separation and drainage
(D) Improve bearing capacity

10. For determining the index properties of soil the sample should be
(A) disturbed (B) undisturbed
(C) intact (D) None of these

11. In standard penetration test conducted at site the recorded values of blow count for every 15 cm penetration at a depth of 45 cm are 5, 10, 15 respectively. The value of SPT blow count (N) that should be used is
(A) 15 (B) 17
(C) 25 (D) 19

12. Match the following

	Type of Boring		Usage
a.	Auger boring	1.	For drilling holes
b.	Rotary drilling	2.	Advancing holes in the ground
c.	Core drilling	3.	drilling holes in clay
d.	Percussion drilling	4.	Sampling for highways, railways etc.

a b c d
(A) 4 1 3 2
(C) 2 3 1 4

a b c d
(B) 4 3 1 2
(D) 1 2 3 4

13. (i) Cement stabilization is done by using mixture of soil + cement + water + compaction + curing
(ii) Chemical stabilization is done by using calcium chloride and sodium silicate
(A) (i) and (ii) are true
(B) (i) and (ii) are false
(C) (i) is true and (ii) is false
(D) (i) is false and (ii) is true

14. A plate load test is conducted on sand on a 500 mm diameter plate. If the plate settlement is 10 mm at a pressure of 200 kPa, the settlement of 0.5 m × 8 m footing will be
(A) 17 mm (B) 20.3 mm
(C) 23.7 mm (D) 18.6 mm

Common Data for Questions 15 and 16:
A group of piles of 20 m length and 0.25 m diameter is installed in a 10 m thick stiff clay layer underlain by rock. The pile soil adhesion factor is 0.3, average shear strength of soil on the sides is 200 kPa, undrained shear strength of soil at base is 200 kPa.

15. The base resistance of a single pile is
(A) 88 kN (B) 84.6 kN
(C) 86.2 kN (D) 88.3 kN

16. The side friction resistance of single pile is
(A) 92.3 kN (B) 94.2 kN
(C) 98 kN (D) 96.5 kN

17. A canal having side slopes 1 : 1 is proposed to be constructed in a cohesive soil to a depth of 10 m below ground surface. The soil properties are $\Phi_U = 20°$.

$C_u = 25$ kPa, $e = 1$, $G_S = 2.65$

If taylor's stability number, S_n is 0.08 and canal is full, the factor of safety with respect to cohesion against failure of canal bank slopes is
(A) 3.85 (B) 3.65
(C) 7.85 (D) 1.7

18. The incorrect statement among the following is
(A) The area ratio should be low
(B) The cutting edge should be thick
(C) The inside clearance should be small
(D) The outside clearance should be small

19. The seismic method of soil exploration cannot be used for
(A) sub surface investigation
(B) hard layers
(C) clays
(D) sandy soils

20. The term mobilized shear strength is referred to as
(A) shear strength
(B) Maximum shear stress
(C) applied shear stress
(D) None of the above

21. The efficiency of pile group for clays is
(A) >100% (B) <100%
(C) =100% (D) None of these

22. Negative skin frictions developed from
(A) A cohesive fill placed over cohesion less soil deposit
(B) lowering of ground water table with resulting ground subsidence
(C) pile driving operations
(D) All the above

23. When the water table rises to ground level in case of cohesion less soil, the bearing capacity is reduced by – %. If it is cohesive soil, the reduction will be____
(A) 20%, 50%
(B) 40%, negligible
(C) 50%, negligible
(D) negligible, 50%

24. Which of the following is false according to terzaghi's theory?
(A) zone I is elastic zone
(B) zone II is radial shear zone
(C) zone III is Rankine's passive zone
(D) zone IV is surcharge zone

25. The cohesion and density of a soil are 4 t/m^2 and 8 t/m^2 respectively. For a factor of safety of 2 and stability number 0.1 the safe height of slope is
(A) 5 m (B) 50 m
(C) 25 m (D) 2.5 m

Answer Keys

1. C	**2.** A	**3.** C	**4.** B	**5.** B	**6.** D	**7.** C	**8.** A	**9.** C	**10.** A
11. C	**12.** B	**13.** A	**14.** C	**15.** D	**16.** B	**17.** A	**18.** B	**19.** B	**20.** C
21. B	**22.** D	**23.** C	**24.** D	**25.** D					

Hints and Explanations

1. Choice (C)

2. Choice (A)

3. Choice (C)

4. Choice (B)

5. Choice (B)

6. Choice (D)

7. Choice (C)

8. Choice (A)

9. Choice (C)

10. Choice (A)

11. The SPT value have to be calculated by leaving the reading of first 15cm and adding the other penetration readings.
i.e., The SPT value = 10 + 15 = 25. Choice (C)

12. Choice (B)

13. Choice (A)

14. Dia of plate = 500 mm
Area of plate = 0.196 m^2
Area of footing = 40 m^2
Settlement of plate = 10 mm
Settlement of footing = ?
Width of plate = 500 × 10^{-3} m = 0.5 m
Width of footing = 8 m

$$\frac{S_f}{S_p}=\left[\frac{B_f\left(B_p+0.3\right)}{B_p\left(B_f+0.3\right)}\right]^2$$

$$\frac{S_f}{10\times10^{-3}}=\left[\frac{8\left(0.5+10.3\right)}{0.5\left(8+0.3\right)}\right]^2$$

S_f = 23.7 mm Choice (C)

15. Base resistance of single pile in clay = $A_b\, CN_C$

$$=\frac{\pi}{4}d^2CN_c=\frac{\pi}{4}\times(0.25)^2\times200\times9$$

= 88.31 kN Choice (D)

16. Side friction resistance
$= A_S \propto C$
= 2 × 3.14 × 0.25 × 0.3 × 200
= 94.2 kN. Choice (B)

17. $S_n = \dfrac{c}{F \times H \times \gamma^1}$

$$\gamma^1 = \frac{\gamma_w (G+e)}{1+e}$$

$$= \frac{9.8 \times (2.65+1)}{1+1} = 8.08 \text{ kN/m}^2$$

$$0.08 = \frac{25}{F \times 10 \times 8.08}$$

$\Rightarrow \quad F = 3.85$ Choice (A)

18. Choice (B)

19. Choice (B)

20. Choice (C)

21. Choice (B)

22. Choice (D)

23. Choice (C)

24. Choice (D)

25. $S_n = \dfrac{C}{F_c \gamma H}$

$\Rightarrow \quad 0.1 = \dfrac{4}{2 \times 8 \times H}$

$$H = \frac{4}{2 \times 8 \times 0.1} = 2.5 \text{ m}$$ Choice (D)