1. The lowest part of a structure is generally referred to as:
   (a) floor slab.
   (b) foundation.
   (c) beam.
   (d) wall.

2. The load of a structure is transferred to the foundation soil through
   (a) floor slab.
   (b) spread footings.
   (c) piles and drilled shafts.
   (d) both (b) and (c).

3. Overstressing the foundation soil can result in
   (a) excessive settlement.
   (b) shear failure of the soil.
   (c) both (b) and (c).
   (d) functional failure of the structure.

4. In soil with low load-bearing capacity, it is more economical to construct the entire
   structure over
   (a) spread footings.
   (b) mat foundation.
   (c) both (a) and (b).
   (d) none of the above.

5. For heavier structures when great depth is required for supporting the load, which of the
   following foundation is generally recommended?
   (a) Spread footings
   (b) Mat foundation
   (c) Piles and drilled shafts
   (d) Both (b) and (c)

6. Which of the following foundations are generally referred to as shallow foundations?
   (a) Spread footings and mat foundations
   (b) Spread footings and pile foundations
   (c) Mat foundations and pile foundations
   (d) Pile and drilled shaft foundations

7. In general, shallow foundations are those foundations that have a depth-of-embedment-to-
   width ratio of approximately
   (a) equal to 4.
   (b) less than 4.
   (c) greater than 4.
   (d) none of the above.
8. The ultimate load per unit area of a shallow foundation which will cause shear failure of the soil supporting the foundation is called
   (a) bearing capacity.
   (b) allowable bearing capacity.
   (c) ultimate bearing capacity.
   (d) none of the above.

9. When the general shear failure of the foundation soil takes place, the failure surface in soil extends to
   (a) the ground surface.
   (b) the base of the footing.
   (c) the water table present in the soil.
   (d) any arbitrary level.

10. In which of the following failure modes does the failure surface in the foundation soil not extend to the ground surface?
    (a) General shear failure
    (b) Local shear failure
    (c) Punching shear failure
    (d) Both (b) and (c)

11. In fairly loose foundation soil, what type of failure mode is expected?
    (a) General shear failure
    (b) Local shear failure
    (c) Punching shear failure
    (d) Both (b) and (c)

12. In Terzaghi’s ultimate bearing capacity theory, the effect of soil above the bottom of the foundation may be assumed to be replaced by an equivalent surcharge,
    (a) \( q = 0.5 \gamma D_f \)
    (b) \( q = \gamma D_f \)
    (c) \( q = 1.5 \gamma D_f \)
    (d) \( q = 2 \gamma D_f \)
    where the symbols have their usual meanings.

13. According to the Terzaghi’s ultimate bearing capacity equation, the ultimate bearing capacity of a strip footing resting on a clayey ground in undrained condition is
    (a) \( q_u = 0 \)
    (b) \( q_u = c' \)
    (c) \( q_u = 5.14 c' \)
    (d) \( q_u = 5.7 c' \)

14. According to the Terzaghi’s ultimate bearing capacity equation, the ultimate bearing capacity of a square and circular footings resting on a clayey ground in undrained condition is
    (a) \( q_u = 0 \)
    (b) \( q_u = 1.3 c' \)
    (c) \( q_u = 6.68 c' \)
    (d) \( q_u = 7.41 c' \)
15. The bearing capacity factor $N_y$ is given as
   (a) $N_y = (N_q - 1) \cot \phi$
   (b) $N_y = (N_q + 1) \tan \phi$
   (c) $N_y = 2(N_q + 1) \tan \phi$
   (d) $N_y = 2(N_q - 1) \tan \phi$
   where the symbols have their usual meanings.

16. If the angle of friction of the foundation soil is $0^\circ$,
   (a) $N_q = 0$
   (b) $N_q = 1$
   (c) $N_q = 5.7$
   (d) $N_q = 5.14$

17. If the angle of friction of the foundation soil, $\phi' = 0^\circ$,
   (a) $N_y = 0$
   (b) $N_y = 1$
   (c) $N_y = 5.7$
   (d) $N_y = 5.14$

18. The general bearing capacity equation considers the following:
   (a) shape factors.
   (b) depth factors.
   (c) load inclination factors.
   (d) all of the above.

19. If the difference between the unit weight of concrete used in the foundation and the unit weight of soil surrounding the foundation is assumed to be negligible, then the net ultimate bearing capacity,
   (a) $q_{net(u)} = q_u$
   (b) $q_{net(u)} = q$
   (c) $q_{net(u)} = q_u - q$
   (d) $q_{net(u)} = q_u + q$
   where the symbols have their usual meanings.

20. The water table will have no effect on the ultimate bearing capacity when
   (a) it is located above the base of the footing.
   (b) it is located at the base of the footing.
   (c) it is located below the base of the footing.
   (d) its depth below the base of the footing is greater than the width of footing.

21. If the net ultimate bearing capacity of a foundation is 30 t/m$^2$, its net allowable load bearing capacity will be
   (a) 10 t/m$^2$
   (b) 15 t/m$^2$
   (c) 30 t/m$^2$
   (d) 90 t/m$^2$
22. The minimum factor of safety used to get net allowable bearing capacity from the known ultimate bearing capacity is generally
(a) 1
(b) 2
(c) 3
(d) 5

23. The tension develops in the soil below the footing when the eccentricity
(a) \( e = \frac{B}{6} \)
(b) \( e < \frac{B}{6} \)
(c) \( e > \frac{B}{6} \)
(d) \( e > \frac{B}{3} \)
where \( Q \) is the dead load of the structure and the live load, \( A \) is the area of the mat, and \( \gamma \) is the unit weight of foundation soil.

24. The net allowable bearing capacity of sand based on elastic settlement is a function of
(a) standard penetration test (SPT) value of sand.
(b) allowable elastic settlement.
(c) depth-to-width ratio for the footing resting on sand.
(d) all of the above.

25. If \( W \) = width of the test pit, and \( B \) = width of the bearing plate for the plate load test, then
(a) \( W > 4B \)
(b) \( W \geq 4B \)
(c) \( W = 4B \)
(d) \( W < 4B \)

26. \( q_{u(footing)} = q_{u(plate)} \) is valid for
(a) clays.
(b) sands.
(c) silts.
(d) gravels.

27. If the ratio of width of footing to width of plate is 5, and elastic settlement of plate on sandy soil is 10 mm, then the settlement of footing will approximately be
(a) 10 mm.
(b) 17 mm.
(c) 28 mm.
(d) 50 mm.
Answers, Hints and Discussion

1. (b)
2. (d)
3. (c)
4. (b)
   Discussion: In soil with low bearing capacity, the size of the spread footings required is impractically large; so in that case, spread footings are not an economical option.
5. (c)
6. (a)
   Discussion: (d) is correct for deep foundations.
7. (b)
   Discussion: (c) is correct for deep foundations.
8. (c)
9. (a)
10. (d)
11. (c)
   Discussion: (a) is correct for dense sands and stiff clays; (b) is correct for sands or clays of medium compaction.
12. (b)
13. (d)
   Discussion: See Eq. (16.11) and Table 16.1; (c) is correct for general bearing capacity equation, see Table 16.2.
14. (c)
   Discussion: See Eqs. (16.12) and (16.13) and Table 16.1; (c) is correct for general bearing capacity equation, see Table 16.2.
15. (c)
16. (b)
17. (a)
18. (d)
   Hint: See Eq. (16.31).
19. (c)
   Hint: See Eq. (16.20).
20. (b)
21. (c)
   Discussion: Eq. (16.22): $q_{ult(net)} = \frac{20}{3} = 10 \ t/m^2$. The minimum value of factor of safety is generally 3.
22. (c)
23. (c)
24. (d)
25. (b)
26. (a)
Hint: See Eq. (16.56).
27. (c)
Hint: See Eq. (16.59).