

Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
Code: 101722

Semester: VII
Subject: Foundation Engineering

Time: 03 Hours
Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory

Q.1 Choose the correct answer of the following: (Any Seven)

[2 x 7 = 14]

- (a) Trapezoidal combined footings are required when
 - I. Space outside exterior column is limited
 - II. Exterior column is heavier
 - III. Both (i) and (ii)
 - IV. Neither (i) nor (ii)
- (b) Influence factor for immediate settlement of footings depends on its
 - I. Size and shape
 - II. Rigidity alone
 - III. Location
 - IV. All of the above
- (c) Which of the following piles is used for the lateral loads coming on the structure?
 - I. Fender pile
 - II. Batter pile
 - III. Compaction pile
 - IV. Displacement pile
- (d) Box caissons are
 - I. Open at both top and bottom
 - II. Closed at both top and bottom
 - III. Closed at top and open at bottom
 - IV. Open at top and closed at bottom
- (e) The net ultimate bearing capacity of a purely cohesive soil
 - I. Depends on the width of the footing and is independent of the depth of the footing.
 - II. Depends on the width as well as the depth of the footing
 - III. Depends on the depth, but is independent of the width of the footing.
 - IV. Is independent of both the width and depth of the footing.
- (f) A well caisson is a foundation facilitating structure sunk in the ground or water, which is:
 - I. Open at top as well as at bottom
 - II. Open at top and closed at bottom
 - III. Open at bottom and closed at top
 - IV. Closed at top as well as at bottom
- (g) In under reamed pile construction, the minimum centre to centre spacing between two adjacent bulbs is equal to
 - I. Diameter of bulb
 - II. 1.5 x Diameter of bulb
 - III. 2 x Diameter of bulb
 - IV. 2.5 x Diameter of bulb
- (h) In the case of footing on the surface or shallow depth in very dense sand which one of the following types of failure is likely to occur?
 - I. Punching shear failure
 - II. Local shear failure
 - III. General shear failure

- IV. None of the above
- (i) The working chamber of pneumatic caissons are kept airtight because.....
- I. To avoid tilting
 - II. To remove the soil
 - III. To prevent water from entering the chamber ✓
 - IV. None of the above
- (j) Quick sand is a
- I. Type of sand
 - II. Flow condition occurring in cohesive soils
 - III. Flow condition occurring in cohesion-less soils ✓
 - IV. Flow condition occurring in both cohesive and cohesion-less soils
- Q.2** (a) Discuss the sharing of loads in a pile group [7]
 (b) A 40 cm diameter pile, 12 m long, has a bell of 2.5 m diameter and 1 m height. If the soil has $\phi' = 25^\circ$, $c_u = 25 \text{ kN/m}^2$ and $\gamma = 18 \text{ kN/m}^3$, estimate the allowable pull out resistance ($FS = 3$). Take the value of $H/B_1 = 3.0$ and $s_r = 1.3$ [7]
- Q.3** (a) Discuss the situations where a well foundation is more suitable than the other types of foundations. [7]
 (b) What are the different shapes of well? [7]
- Q.4** ✓ (a) What is the N value of SPT? Explain the corrections to be applied to the observed value of N. [7]
 (b) What will be the gross and net safe bearing pressure of sand having $\phi = 36^\circ$ and effective unit weight 1.8 tonnes/m^3 under the following cases: [7]
- (i) 1 m wide strip footing ✓
 - (ii) 1 m x 1 m square footing ✓
- Consider the footings are placed at a depth of 1 m from ground surface and water table is at a great depth. Assume a factor of safety of 3.0. Use Terzaghi's theory. Given for $\phi = 36^\circ$ from Terzaghi's chart $N_q = 47$ and $N_\gamma = 43$.
- Q.5** (a) Explain the field penetration test of SPT, and DCPT methods in soil exploration. [7]
 (b) Explain briefly the group action and efficiency of pile group. [7]
- Q.6** ✓ (a) A raft foundation is supported by pile group consisting of 15 piles arranged in 3 rows. The diameter and length of each pile are 300 mm and 15 m respectively. The spacing between the piles is 1.2 m. The foundation soil consists of a soft caly layer having $c = 3.2 \text{ t/m}^2$ and $Y = 1.9 \text{ t/m}^2$. Determine the capacity of the pile group. [7]
 (b) A timber pile is being driven with a drop hammer weighing 20 kN and having a free fall of 1m. The total penetration of the pile is the last five blows is 30 mm. Determine the load carrying of the pile using the Engineering News Formula. [7]
- Q.7** (a) Describe the three of following- [7]
- (i) Critical Damping
 - (ii) Viscous Damping
 - (iii) Resonant Frequency
 - (iv) Free Vibration without damping
 - (v) Forced vibration with damping
- (b) Amplitude of vibration of a SDOF system whose natural frequency 2 Hz and mass 100 Kg vibrating freely gets reduced to 80% after 3 seconds vibration. Calculate the following. [7]
- (i) Fraction of Critical damping
 - (ii) Logarithmic decrement

- (iii) Damping constant
- (iv) Stiffness

Q.8 (a) What safety measures should be taken in design of machine foundation. [4]

(b) Explain about safety of retaining wall against sliding and overturning. Also write general design requirements of retaining wall. [4]

(c) Determine the natural frequency of a machine foundation having a base area of 2 m x 2.5 m and mass 17.5 Kg, including mass of machine. Take coefficient of elastic uniform compression (C_u) of soil = 40000 KN/m³ [6]

Q.9 ✓

Write short notes on any four of the following:-

[3.5x4]

- I. Under reamed pile ✓
- II. Consolidation in soil ✓
- III. Effect of water table on bearing capacity of shallow foundation
- IV. Group action of pile ✓
- V. Types of foundation ✓

