KATHMANDU UNIVERSITY
End Semester Examination
May/June, 2022

Marks Scored:

Level : B.E
Year : III
Course : CIEG 309
Semester : II

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No.:
Date :

SECTION "A"
[20Q. × 0.5=10 marks]

Encircle the most appropriate answer.

1. The maximum pressure which a soil can carry without shear failure is called
   a. Ultimate bearing capacity
   b. Net ultimate bearing capacity
   c. Net safe bearing capacity
   d. Safe bearing capacity

2. Terzaghi's bearing capacity factors N_c, N_q and N_γ are functions of
   a. Cohesion only
   b. Angle of internal friction only
   c. Coefficient of active earth pressure at rest and angle of internal friction
   d. Coefficient of active earth pressure only

3. Contact pressure beneath a rigid footing resting on soil is
   a. Uniform throughout
   b. More outside the rigid footing
   c. More at edges compared to middle
   d. Less at edges compared to middle

4. A pile is being driven with a drop hammer weighing 1800 kg and having a free fall of 1.00 m. If the penetration with last blow is 5 mm, the load carrying capacity of the pile, according to the Engineering News formula, is
   a. 52 tonnes
   b. 50 tonnes
   c. 46 tonnes
   d. 48 tonnes

5. Which is the following statement incorrect?
   a. Pier has a footing
   b. Caisson doesn't have a footing
   c. Pile doesn't have a footing
   d. Pier has small circular columns than pile to support and transfer load

6. A retaining wall 6 m high supports a backfill with a surcharge angle of 10°. The back of the wall is inclined to the vertical at a positive batter angle of 5°. If the angle of wall friction is 7°, then the resultant active earth pressure will act at a distance of 2 m above the base and inclined to the horizontal at an angle of
   a. 7°
   b. 10°
   c. 17°
   d. 12°

7. The best foundation that is used when the soil mass has low bearing capacity is
   a. Strap footing
   b. Trapezoidal combined footing
   c. Mat footing
   d. Rectangular combined footing

8. The total active earth pressure due to dry back fill with no surcharge, acts at H/3 above the base of the wall and is directly proportional to
   a. H^3
   b. H^2
   c. $\sqrt{H}$
   d. H

9. A failure wedge develops if a retaining wall
   a. Sinks downwards
   b. Moves towards the backfill
   c. Moves away from the backfill
   d. Stresses equally by vertical and horizontal forces

10. The active earth pressure of a soil is proportional to (where φ is the angle of friction of the soil)
a. $\tan^2(45° - \varphi/2)$ b. $\tan^2(45° + \varphi/2)$ c. $\tan(45° - \varphi)$ d. $\tan(45° + \varphi)$

11. Which is the following statement incorrect?
a. Bearing capacity of a soil depends on the type of soil
b. Bearing capacity of a soil depends upon shape and size of footing
c. Bearing capacity of a soil depends upon the amount and direction of load
d. Bearing capacity of a soil is independent of rate of loading

12. The maximum load carried by a pile, when it continues to sink without further increase of load, is known as.
a. Ultimate load carrying capacity b. Net bearing capacity
c. Safe bearing capacity d. Allowable bearing capacity

13. Which one of the following statements is false for Mohr-Coulomb envelope?
a. Mohr Coulomb suggests that the relationship between shear strength and normal stress, is adequately represented by the straight line
b. Mohr Coulomb theory suggests that, though the shear stress depends on the normal stress, the relation is not linear
c. Coulomb and Mohr suggest that a definite relationship exists among the principal stress and the angle of internal friction
d. Mohr Coulomb theory is used to obtain failure envelope

14. If a soil undergoes a change in shape and volume by application of external loads over it, but recovers its shape and volume immediately after removal of the load, the property of the soil is said to be
a. Dilation of soils b. Compressibility of soils
c. Elasticity of soils d. Resilience of soils

15. In raft footing, if the Center of Gravity of the load coincide with the centroid of the raft, the upward load is considered as
a. Non-Uniform pressure b. Eccentric pressure
c. Excess pressure d. Uniform pressure

16. The intensity of active earth pressure at a depth of 10 metres in dry cohesionless sand with an angle of internal friction of 30° and with a unit weight of 1.8 kN/m3, is
a. 4 kN/m^2 b. 5 kN/m^2 c. 6 kN/m^2 d. 7 kN/m^2

17. Soil improvement is not done to
a. Increase the shear strength b. Decrease the compressibility
c. Increase bearing capacity d. Increase settlement

18. The equation $\tau = c + \sigma \tan \varphi$ is given by
a. Rankine b. Coulomb c. Coleman d. Mohr

19. Sheet pile walls are not used for
a. Water front structures b. Superstructures
c. River bank protection d. Retaining in fill materials

20. A caisson which is open at the bottom but closed at the top is
a. Open Caisson b. Closed Caisson
c. Pneumatic caisson d. Well Caisson

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SECTION "B"

Attempt *ALL* questions. Assume suitable data where necessary.

1. Explain the importance of various geotechnical properties of soil required in foundation engineering. Explain standard penetration test with proper illustration. How can the standard penetration values be corrected for dilatancy and over burden pressure? [2+3]

2. What do you understand by eccentrically loaded foundation? How does the effective area of a shallow foundation change with one-way eccentricity and two-way eccentricity? [2+3]

3. A shallow footing of 1.8 m width, its base at a depth of 1.2 m is resting on dry sand. The water table is 1.2 m below the base of footing. Find the change in ultimate bearing capacity of footing if the water rises up to the depth 0.6 m below the ground level. Take: $N_c = 95.8$, $N_q = 81.4$, $N_\gamma = 100.5$, $G = 2.70$ and dry unit weight of sand 16 kN/m³. [5]

4. The plan of a mat foundation with square columns is shown in Figure 1. Assuming that mat is rigid, determine the soil pressure distribution at points A, B, C and D which are mid points of respective columns. All the column is of the size 0.5 m × 0.5 m. [4]

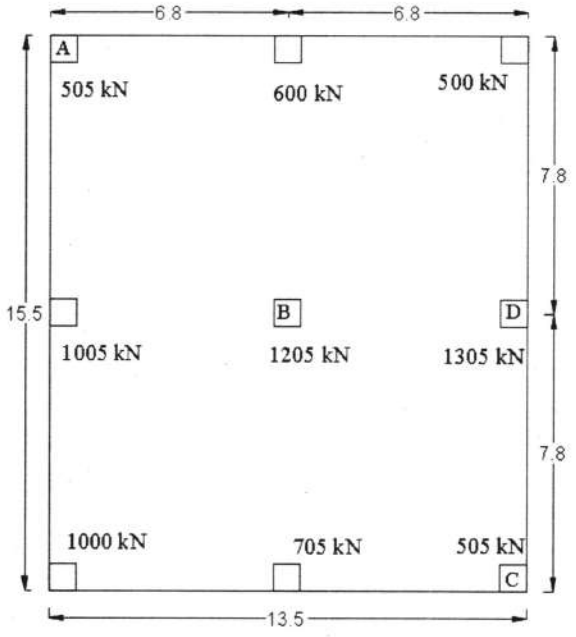

Figure 1 : Rigid Mat Foundation (All the dimensions are in meters)

5. Describe briefly about the stability of retaining walls against bearing capacity. A retaining wall is 7.6 m high with soil supported consists of 5.1 m sand (Υ = 18.5 kN/m³, ϕ = 34°) overlying saturated denser sand (Υ = 19.3 kN/m³, ϕ = 31°). The water level is at the upper surface of denser sand. Draw a sketch of the distribution of the active pressure on wall stating the principal values. Calculate the total thrust per meter of the wall and its point of application. Assume backfill is horizontal at the surface. [3+5]

6. An anchored sheet pile wall having a total pile length of 11.1 m retains the soil of unit weight 19.1 kN/m³ and ø = 29° up to height of 6.5 m. The surface is level with the top of the wall. The tie rods are 1.2 m below the surface and are spaced 3 m apart horizontally. Neglecting friction on the surface of the piling and assuming "free earth support", Determine: [3+2]

i. Proportion of mobilized passive resistance on totally embedded pile.
ii. The tension developed in each anchor ties

7. Describe pile load test with its procedure and its significance. Differentiate between pile, pier and caisson foundations. [4+4]