

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. $\tan^2 (45^\circ - \phi/2)$ b. $\tan^2 (45^\circ + \phi/2)$ c. $\tan (45^\circ - \phi)$ d. $\tan (45^\circ + \phi)$
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/m^3 , 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 $\tau = c + \sigma \tan \phi$ 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/m^3 . [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 $0.5 \text{ m} \times 0.5 \text{ m}$. [4]

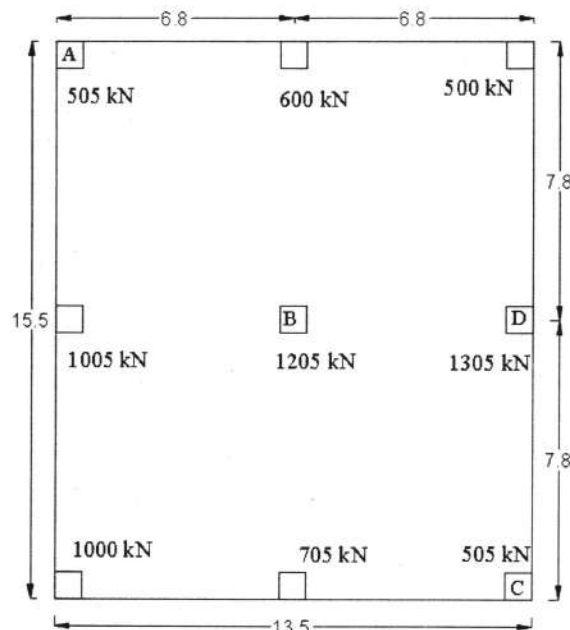


Figure 1 : Rigid Mat Foundation (All the dimensions are in meters)

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 ($\gamma = 18.5 \text{ kN/m}^3$, $\phi = 34^\circ$) overlying saturated denser sand ($\gamma = 19.3 \text{ kN/m}^3$, $\phi = 31^\circ$). 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/m^3 and $\phi = 29^\circ$ 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]

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SECTION "A"

[20 Q × 0.5 = 10 marks]

Encircle the most appropriate answer.

- Two plates of thickness 10 mm and 12 mm are connected together with fillet weld. What is the minimum size of fillet weld?
a. 3 mm b. 4 mm c. 5 mm d. 6 mm
- The partial factor of safety for shop welding is
a. 1.25 b. 1.1 c. 1.2 d. 1.5
- A steel plate is 30 cm wide and 10 mm thick. If the diameter of the bolt is 18 mm, the net section area of the plate is
a. 30 cm² b. 27 cm² c. 27 mm² d. 270 cm²
- The design tensile strength of a member due to yielding of gross section, T_{dg} is given by
a. $A_g f_u / \gamma_{m1}$ b. $A_g f_y / \gamma_{m1}$ c. $A_g f_y / \gamma_{m0}$ d. $A_g f_u / \gamma_{m0}$
- The slenderness ratio for a member if always in tension (other than pretensioned member) is
a. 180 b. 400 c. 250 d. 300
- High strength bolts are designed on the basis of
a. Friction b. Tension c. Compression d. Shear
- The diameter of hole should be more than _____ mm than diameter of bolt
a. 1 b. 1.5 c. 2 d. 2.5
- The effective throat thickness of a fillet welds is K times the size of weld. For 90° angle between fusion faces, the value of K is
a. 0.7 b. 0.65 c. 0.6 d. 1.0
- Minimum edge distance and end distance for rolled, Hand cut is
a. 1.7 x hole diameter b. 1.2 x hole diameter
c. 1.5 x hole diameter d. 2.0 x hole diameter
- If center of mass coincides with center of stiffness of masonry floor system, such floor system is called as
a. Torsionally coupled system b. Torsionally uncoupled system
c. Insufficient data d. Both a and b

11. The efficiency of welded joint is _____ than bolted joint.
a. More b. Less c. Same d. Can't say
12. If lateral load is in the direction of the length of masonry wall, then failure may occur due to
a. In Plane b. Toppling of wall materials
c. Out of Plane d. horizontal and vertical cracks
13. For a single unequal angle tie member, the leg preferred for outstanding side is
a. Shorter Leg b. Any of two
c. Longer leg d. longer if bolted shorter if welded
14. Minimum number of battens required in a built-up column are
a. 2 b. 3 c. 4 d. 5
15. If M18 bolts are used in lacing bar for connection, then minimum width of lacing bar must be
a. 45 mm b. 54mm c. 60mm d. 73mm
16. For same load, unsupported length and end conditions, a lacing column is compared to the batten column is
a. Stronger b. Weaker c. Equal d. cannot be compared
17. As per IS:800, the maximum deflection of beam should not exceed
a. $L/180$ b. $L/250$ c. $L/325$ d. $L/360$
18. To ensure that compression flange of beam is restrained from moving laterally, the cross section must be
a. Plastic b. semi compact c. compact d. Thin
19. The value of s/d of a solid teak wood column is 8. The column is classified as
a. Short b. Long c. intermediate d. not enough data
20. Bending moment of timber beam should be multiplied by form factor if its depth is greater than
a. 250 mm b. 300 mm c. 350 mm d. 400 mm