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#Question:1
# Input values for the calculation
BulkDensity = float(input("Enter the value of Bulk Density of soil: "))
SatDensity = float(input("Enter the value of Saturated Density of soil: "))
WaterDensity = float(input("Enter the unit Weight of Water: "))
Df = float(input("Enter the value of depth of footing: "))
Dw = float(input("Enter the value of water table above footing level: "))
Dw1 = float(input("Enter the value of Water table below the level of footing: "))
B = float(input("Enter the value of width of footing: "))
Ng = float(input("Enter the value of Ng: "))
N_gamma = float(input("Enter the value of N gamma (N): "))

# Submerged density of soil
SubDensity = SatDensity - WaterDensity
print("Submerged Weight of soil is:", SubDensity)

# CASE A: Bearing capacity of soil when water table is at ground level
print("\nCASE A")
qu_A = (SubDensity * Df * N_gamma) + (0.5 * 0.8 * B * SubDensity * N_gamma)
print("The value of ultimate bearing capacity of soil is:", qu_A)

# Approximate calculation of Bearing capacity with Rw and Rw1
Rw = 0.5 + 0.5 * (Dw / B)
print("The value of Rw is:", Rw)

Rw1 = 0.5 + 0.5 * (Dw1 / B)
print("The value of Rw1 is:", Rw1)

qu_approx_A = (BulkDensity * Df * N_gamma * Rw) + (0.5 * 0.8 * B * BulkDensity * N_gamma
print("The value of ultimate bearing capacity of soil is:", qu_approx_A)

# CASE B: Bearing capacity when the water table is shifted
print("\nCASE B")
qu_B = (BulkDensity * Df * Ng) + (0.5 * 0.8 * B * SubDensity)
print("The value of ultimate bearing capacity is:", qu_B)

# Update Dw and Dw1 for CASE B if necessary
Dw = float(input("Enter the value of water table above footing level: "))
Dw1 = float(input("Enter the value of Water table below the level of footing: "))

# Recalculate Rw and Rw1
Rw = 0.5 + 0.5 * (Dw / B)
print("The value of Rw is:", Rw)

Rw1 = 0.5 + 0.5 * (Dw1 / B)
print("The value of Rw1 is:", Rw1)

qu_approx_B = (BulkDensity * Df * Ng * Rw) + (0.5 * 0.8 * B * BulkDensity * Ng * Rw1)
print("The approximate value of ultimate bearing capacity is:", qu_approx_B)

# CASE C: Bearing capacity with depth of water below footing
print("\nCASE C")
x = float(input("Enter the value of depth of water below footing: "))
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qu_C = (BulkDensity * Df * Ng) + (0.5 * 0.8 * BulkDensity * x) + (SubDensity * (B - x) *
print("The value of ultimate bearing capacity is:", qu_C)

# Update Dw and Dw1 for CASE C if necessary
Dw = float(input("Enter the value of water table above footing level: "))
Dw1 = float(input("Enter the value of water table below the level of footing: "))

# Recalculate R and Pal
R = 0.5 + 0.5 * (Dw / B)
print("The value of R is:", R)

Pal = 0.5 + 0.5 * (Dw1 / B)
print("The value of Pal is:", Pal)

qu_final_C = (BulkDensity * Df * Ng * R) + (0.5 * 0.8 * B * BulkDensity * Ng * Pal)
print("The value of ultimate bearing capacity is:", qu_final_C)
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Enter the value of Bulk Density of soil: 18
Enter the value of Saturated Density of soil: 20
Enter the unit Weight of Water: 10
Enter the value of depth of footing: 2
Enter the value of water table above footing level: 0
Enter the value of Water table below the level of footing: 0
Enter the value of width of footing: 3
Enter the value of Ng: 33
Enter the value of N gamma (N): 34
Submerged Weight of soil is: 10.0

CASE A
The value of ultimate bearing capacity of soil is: 1088.0
The value of Rw is: 0.5
The value of Rw1 is: 0.5
The value of ultimate bearing capacity of soil is: 979.2

CASE B
The value of ultimate bearing capacity is: 1200.0
Enter the value of water table above footing level: 3
Enter the value of Water table below the level of footing: 0
The value of Rw is: 1.0
The value of Rw1 is: 0.5
The approximate value of ultimate bearing capacity is: 1544.4

CASE C
Enter the value of depth of water below footing: 1
The value of ultimate bearing capacity is: 1855.2
Enter the value of water table above footing level: 3
Enter the value of water table below the level of footing: 1
The value of R is: 1.0
The value of Pal is: 0.6666666666666666
The value of ultimate bearing capacity is: 1663.2
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#Question:2
# Input values for the calculation
UCS = float(input("Enter the value of UCS of soil: "))
Cu = UCS / 2  # Calculating cohesion
B = float(input("Enter the value of dimension of pile: "))
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L = float(input("Enter the length of pile: "))
Alpha = float(input("Enter the value of adhesion factor: "))
Nc = float(input("Enter the value of Nc: "))

# Calculating the base area of the pile
Ab = B * B
print("The Base area of footing is:", Ab)

# Calculating the surface area of the pile
As = 4 * B * L
print("The value of cohesion of soil (Cu) is:", Cu)

# Calculating the ultimate end bearing capacity (Qpu)
Qpu = Cu * Nc * Ab
print("Qpu (Ultimate end bearing capacity):", Qpu)

# Calculating the skin friction resistance (Qf)
Qf = Alpha * Cu * As
print("Qf (Skin friction resistance):", Qf)

# Calculating the ultimate load carrying capacity (Qu)
Qu = Qpu + Qf
print("The value of ultimate load carrying capacity of pile (Qu) is:", Qu)
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Enter the value of UCS of soil: 75
Enter the value of dimension of pile: 0.45
Enter the length of pile: 15
Enter the value of adhesion factor: 0.8
Enter the value of Nc: 9
The Base area of footing is: 0.2025
The value of cohesion of soil (Cu) is: 37.5
Qpu (Ultimate end bearing capacity): 68.34375
Qf (Skin friction resistance): 810.0
The value of ultimate load carrying capacity of pile (Qu) is: 878.34375
```

```
# Input values for calculation
BulkDensity = float(input("Enter the value of Bulk Density of soil (kN/m^3): "))
SatDensity = float(input("Enter the value of Saturated Density of soil (kN/m^3): ")
WaterDensity = float(input("Enter the unit Weight of Water (kN/m^3): "))
Df = float(input("Enter the value of depth of footing (m): "))
B = float(input("Enter the value of width of footing (m): "))
Ng = float(input("Enter the value of Ng: "))
N_gamma = float(input("Enter the value of N gamma (N): "))

# Calculate submerged density of soil
SubDensity = SatDensity - WaterDensity
print("Submerged Weight of soil is:", SubDensity, "kN/m^3")

# Input values for water table above and below footing
M = int(input("Number of data values for Water table above footing level: "))
N = int(input("Number of data values for Water table below footing level: "))

# Initialize lists to store water table depths
Dw = []
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Dw1 = []

# Loop to collect values for water table above footing level
for i in range(1, M + 1):
    Depth_Dw = float(input(f"Enter the value of water table above footing level (Dw
    Dw.append(Depth_Dw)
    # Calculate reduction factor Rw
    Rw = 0.5 + 0.5 * (Depth_Dw / B)
    print(f"The value of Rw for case {i} is:", Rw)

# Loop to collect values for water table below footing level
for j in range(1, N + 1):
    Depth_Dw1 = float(input(f"Enter the value of water table below footing level (D
    Dw1.append(Depth_Dw1)
    # Calculate reduction factor Rw1
    Rw1 = 0.5 + 0.5 * (Depth_Dw1 / B)
    print(f"The value of Rw1 for case {j} is:", Rw1)

# Calculating the ultimate bearing capacity (qu)
for i in range(M):
    for j in range(N):
        qu = (BulkDensity * Df * Ng * (0.5 + 0.5 * (Dw[i] / B))) + (0.5 * 0.8 * B *
        print(f"The ultimate bearing capacity (qu) for Dw = {Dw[i]} and Dw1 = {Dw1[
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Enter the value of Bulk Density of soil (kN/m^3): 18
Enter the value of Saturated Density of soil (kN/m^3): 20
Enter the unit Weight of Water (kN/m^3): 10
Enter the value of depth of footing (m): 2
Enter the value of width of footing (m): 3
Enter the value of Ng: 33
Enter the value of N gamma (N): 34
Submerged Weight of soil is: 10.0 kN/m^3
Number of data values for Water table above footing level: 3
Number of data values for Water table below footing level: 3
Enter the value of water table above footing level (Dw) for case 1 (m): 0
The value of Rw for case 1 is: 0.5
Enter the value of water table above footing level (Dw) for case 2 (m): 1
The value of Rw for case 2 is: 0.6666666666666666
Enter the value of water table above footing level (Dw) for case 3 (m): 2
The value of Rw for case 3 is: 0.8333333333333333
Enter the value of water table below footing level (Dw1) for case 1 (m): 0
The value of Rw1 for case 1 is: 0.5
Enter the value of water table below footing level (Dw1) for case 2 (m): 0
The value of Rw1 for case 2 is: 0.5
Enter the value of water table below footing level (Dw1) for case 3 (m): 1
The value of Rw1 for case 3 is: 0.6666666666666666
The ultimate bearing capacity (qu) for Dw = 0.0 and Dw1 = 0.0 is: 961.2 kN/m^2
The ultimate bearing capacity (qu) for Dw = 0.0 and Dw1 = 0.0 is: 961.2 kN/m^2
The ultimate bearing capacity (qu) for Dw = 0.0 and Dw1 = 1.0 is: 1083.6 kN/m^2
The ultimate bearing capacity (qu) for Dw = 1.0 and Dw1 = 0.0 is: 1159.2 kN/m^2
The ultimate bearing capacity (qu) for Dw = 1.0 and Dw1 = 0.0 is: 1159.2 kN/m^2
The ultimate bearing capacity (qu) for Dw = 1.0 and Dw1 = 1.0 is: 1281.6 kN/m^2
The ultimate bearing capacity (qu) for Dw = 2.0 and Dw1 = 0.0 is: 1357.1999999999998
The ultimate bearing capacity (qu) for Dw = 2.0 and Dw1 = 0.0 is: 1357.1999999999998
The ultimate bearing capacity (qu) for Dw = 2.0 and Dw1 = 1.0 is: 1479.6 kN/m^2
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