

Mid-West University
Examinations Management Office

End Semester Examinations-2080

Master level/Structural Engineering /1st Semester

Time: 3 hours

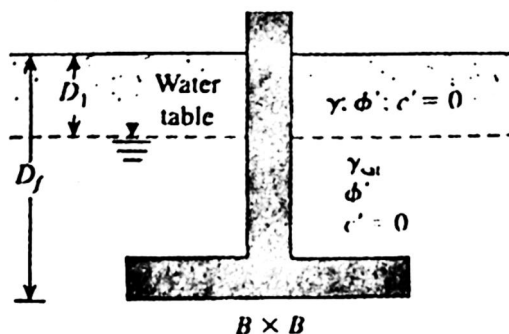
Subject: Advance Geotechnical Engineering (STR515/MGTH 505)

Full Marks: 60

Pass Marks: 30

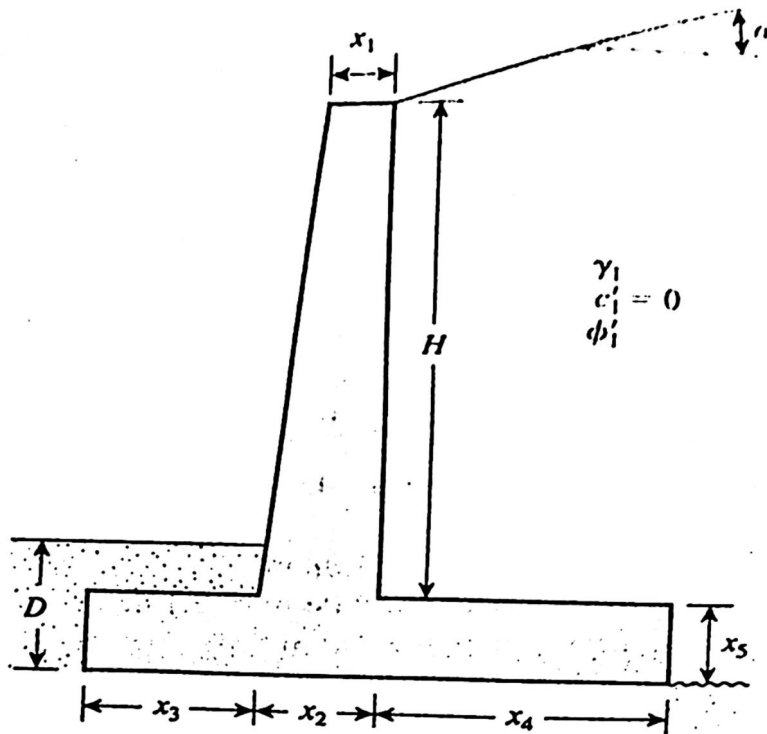
- Attempt all the questions
- Figures in the margin indicate full marks.
- Assume suitable values, with a stipulation, if necessary.
- Candidates are required to answer the questions in their own words as far as possible.

1. Karnali Province Ministry of Physical Infrastructure Development is planning to construct a Building having plot area 3500 Km² at Birendranagar, Surkhet. For the purpose, a detailed soil survey has to be conducted. As a geotechnical engineer, what are the steps to be carried out during subsurface exploration? Plan the number and depth of boreholes to be drilled for soil investigation. What kind of tests you are going to perform with the recommended soil samples in the laboratory for the design of building? Prepare the standard format of geotechnical report to be submitted to the client. [10]
2. What type of foundation will you recommend for sites which are highly compressible? A soil profile at a site for proposed office building consists of a layer of fine sand 10.4m thick above a layer of soft normally consolidated clay 2m thick. Below the soft clay is a deposit coarse sand. The ground water table was observed at 3m below ground level. The void ratio of sand is 0.76 and the water content of the clay is 43%. The building will impose a vertical stress increase of 140KPa at the middle of the clay layer. Estimate the primary consolidation settlement of the clay. Assume the soil above water table to be saturated. $C_c=0.3$ and $G_s=2.7$. [10]
3. What are the factors affecting bearing capacity of soil? How can you boost up bearing capacity in case of very loose cohesionless soils? A square foundation ($B \times B$) has to be constructed as shown. Assume $\gamma=16.5\text{KN/m}^3$, $\gamma_{\text{sat}}=18.55\text{KN/m}^3$, $\phi=34^\circ$, $D_f=1.22\text{m}$, $D_1=.61\text{m}$. The Gross allowable load Q_{all} with FOS =2.5 is 500KN. Take $N_q=29.44$, $N_\gamma=41.06$. Determine the size of footing [10]

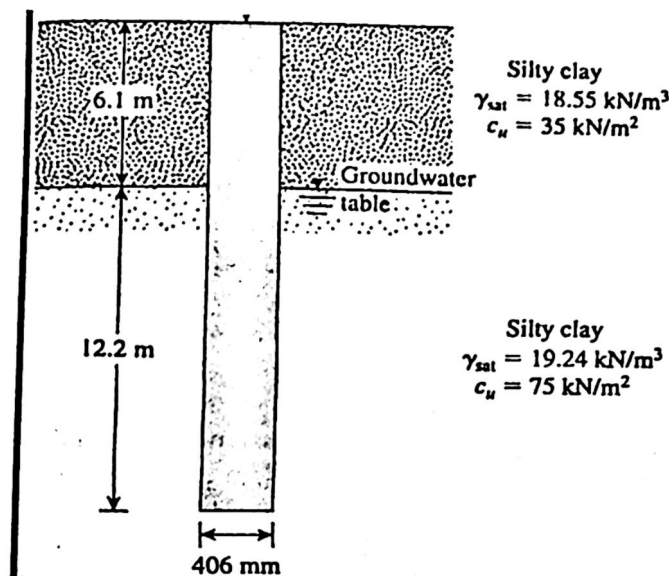


4. Many newly constructed infrastructures in Nepal are confronting with geotechnical failure generally in the form of slope failure, dam failure and subsidence of bridges which are occurring at alarming rate. What can be the reason behind this? As a geotechnical engineer suggest the recommendation to cope with aforementioned geotechnical hazards. As an emerging field, what can be the new trends in geotechnical engineering? What can be the soil improvement techniques in case of black cotton soil? [10]

5. Why retaining walls are generally designed for active earth pressure? Why cohesionless soils are preferred for backfill materials in comparison to clayey soils? Calculate the FOS of given Cantilever retaining Wall and check it with respect to Overturning, Wall dimensions: $H=6.5\text{m}$, $x_1=0.4\text{m}$, $x_2=0.6\text{m}$, $x_3=1.5\text{m}$, $x_4=3.5\text{m}$, $x_5=0.95\text{m}$, $D=1.75\text{m}$, $\alpha=0^\circ$. Soil Properties: $\gamma_1=16.5\text{KN/m}^3$, $\phi_1=32^\circ$, $\phi_2=28^\circ$, $C_2=30\text{KN/m}^2$, $\gamma_2=17.6\text{KN/m}^3$. For $\phi_2=28^\circ$, $N_q=17.81$, $N_c=31.61$, $N_y=13.7$. [10]



6. What are the pre-requisites before the design of foundation for any structure? Calculate the skin resistance (Q_s) by α , β and λ method. For β method use $\Phi_R=30^\circ$ for all clay layers. The top 6.1 m of clay is normally consolidated. The bottom clay layer has an $\text{OCR}=2$. Diameter of pile=406mm. Take $\alpha=0.74$ for first layer and 0.54 for last layer. Take $\lambda=0.173$ (10)



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