

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF CIVIL AND WATER ENGINEERING
FACULTY OF INDUSTRIAL TECHNOLOGY
BACHELOR OF ENGINEERING (HONOURS) DEGREE
SECOND SEMESTER-PART V EXAMINATIONS AUGUST 2009
FOUNDATION ENGINEERING DESIGN TCW 5202

INSTRUCTIONS

Answer Question ONE and any two from the rest.

Time 4 hours.
Total Marks 100

QUESTION ONE

The cantilever retaining wall shown in Fig. 1.0 is backfilled with granular material having a unit weight, γ , of 20 kN/m² and an internal angle of friction, ϕ , of 30°. Assuming that the allowable bearing pressure of the soil is 120kN/m², coefficient of friction is 0.4, and the surcharge is 40kN/m²

- 1.0 Determine the factors of safety against sliding and overturning
- 2.0 Calculate the ground bearing pressure
- 3.0 Design the wall and base reinforcement assuming $f_{cu} = 30 \text{ N/mm}^2$ and $f_y = 460 \text{ N/mm}^2$.

Marks 50

QUESTION TWO

A raft foundation shown in Figure 2.0 carries a uniformly distributed load of 200 kN/m². Estimate the vertical pressure at a depth of 9.0m below the point 'O' marked in the figure.

Marks 25

QUESTION THREE

A stratum of clay with an average liquid limit of 46% is 7.8m thick. Its surface is located at a depth of 11.2 m below the ground surface. The natural water content of the clay is 38% and the specific gravity of soil is 2.75. Between the ground surface and the clay, the sub-soil consists of fine sand.

The water table is located at 4.4 m below the ground surface. The average submerged unit weight of sand is 10.6 kN/m² and the unit weight of sand located above the water table is 17.2 kN/m². From the geological evidence, it is known that the clay is normally consolidated. The weight of the building that will be constructed on sand above the clay is likely to increase the effective over-burden on the clay by 42 kN/m². Estimate the settlement of the building layer.

For clay $\gamma_{sub} = \{ (G - 1) / (1 - e) \} \gamma_w$; Compression Index $C_c = 0.324$
and $e = w \cdot G$ where e = water content; G == specific gravity; e = void ratio

Marks 25

QUESTION FOUR

A square group of 25 piles extends between depths of 2.0m and 12.0m in a deposit of 20.0m thick stiff clay overlying rock. The piles are 500mm diameter and are spaced at 1.0m centre to centre in the group. The undrained shear strength of the clay at the pile base level is 180 kN/m^2 and the average value of the undrained shear strength over the depth of the pile is 110 kN/m^2 .

The adhesion coefficient α is 0.45.

Calculate the capacity of the pile group considering an overall factor of safety equal to 3.0 against failure.

Marks 25

