MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 411 FOUNDATION ENGINEERING II

DATE: **TIME:**

INSTRUCTIONS

SECTION A (COMPULSORY)

QUESTION ONE (30 MARKS)

a) With aid of well labelled sketches, describe the following types of retaining wall

i) Counterfort gravity retaining walls. (3 marks)

ii) Cantilever retaining walls. (3 marks)

b) With aid of well labelled sketches, describe the following types of shallow foundations:

i) Cantilever footing (3 marks)

ii) Raft foundation (3 marks)

c) State the procedure for designing and proportioning loading for equal settlement of a footing. (6 marks)

d) With a well labeled sketch of a reinforced cement concrete mat foundation, show the zones of maximum punching shear, bending moment, and diagonal shear. (6 marks)

e) With aid of sketches, describe the following types of coffer dams:

i) Earth (2 marks)

ii) Braced (2 marks)

iii) Circular cellular (2 marks)

SECTION B (ATTEMPT ANY TWO QUESTIONS)

QUESTION TWO (20 MARKS)

a) Check the stability of the gravity retaining wall shown in the Figure Q2A. Take allowable soil pressure equal to 600 kN/m^2. Use Coulomb's theory. (10 marks)

b) Design a strap footing for the two columns shown in Figure Q2B. The allowable soil pressure is 100 kN/m^2. Take the eccentricity of the footing of column 1 as 1 m. Draw the shear force and bending moment diagrams for the loading configuration shown. (10 marks)

QUESTION THREE (20 MARKS)

a) Check the stability of the cantilever retaining wall shown in Figure Q3A. The allowable soil pressure is 500 kN/m^2. (10 marks)

b) The plan of a mat foundation with 9 columns is shown in Figure Q3B. Assuming that the mat is rigid, determine the soil pressure distribution. All the columns are of the size 0.6 m x 0.6 m. Draw the shear force and bending moment diagrams for the strip ABFE. (10 marks)

QUESTION FOUR (10 MARKS)

a) Determine the depth of embedment for the anchored sheet pile shown in Figure Q4A. Also determine the force in the anchor per metre run. Assume fixed-end support conditions.

b) Design a trapezoidal footing for the two columns shown in Figure Q4B. Take allowable soil pressure as 200 kN/m^2. Sketch the pressure distribution underneath the foundation and the shear force and bending moment diagrams along line AB

QUESTION FIVE

a) Design a circular cellular coffer dam of total height 15 m resting on rock as shown in Figure Q5A. Take allowable interlock tension of 1500 kN/m, $\varphi = 30^o$, $\delta = 25^o$, K = 0.6, f = 0.30, $\gamma_w = 10$ kN/m^3, $\gamma = 18$ kN/m^3. The diameter of the main cells is 15 m (10 marks)

b) For the braced cuts shown in Figure Q5B, draw the earth pressure envelope. Determine the loads in struts (1), (2), (3) and (4), assuming the struts are hinged at levels 1, 2, 3, and 4. The spacing of the struts is 2.5 m. Take $\gamma = 18$ kN/m^3, and c = 30 kN/m^2 (10 marks)

Figures

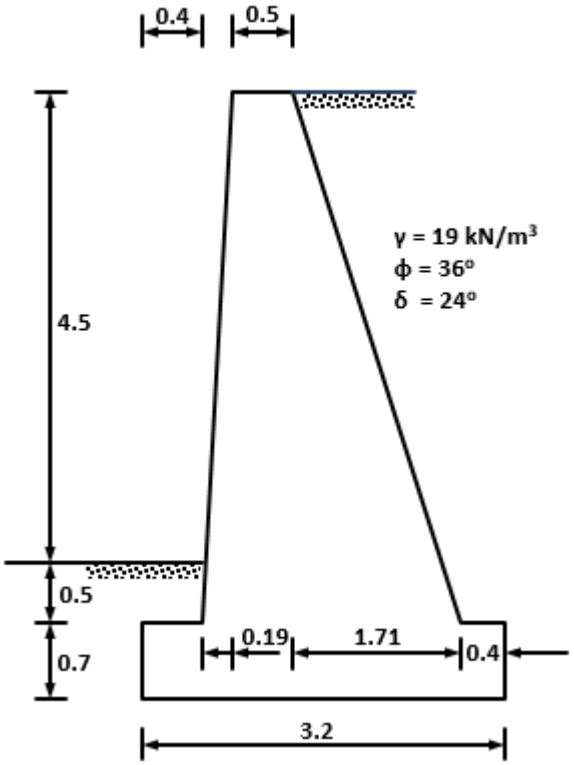

Figure Q2A

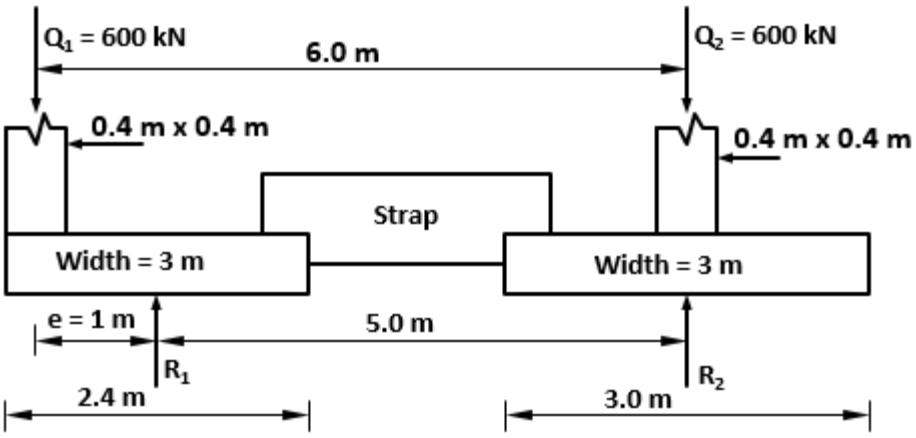

Figure Q2B

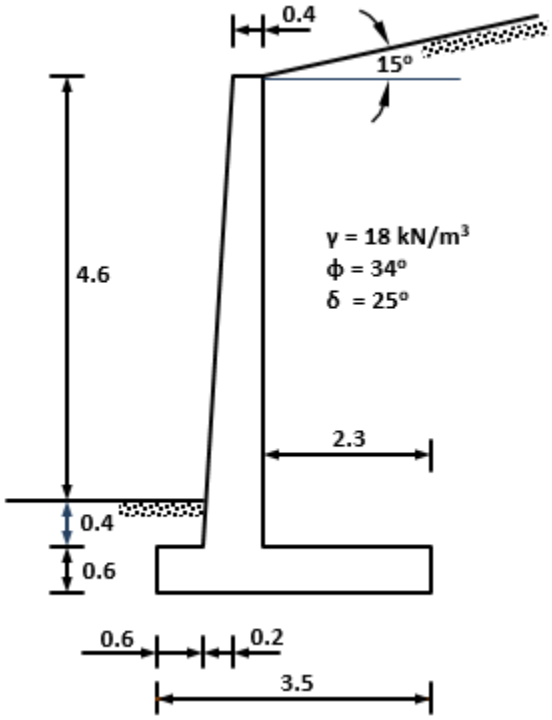

Figure Q3A

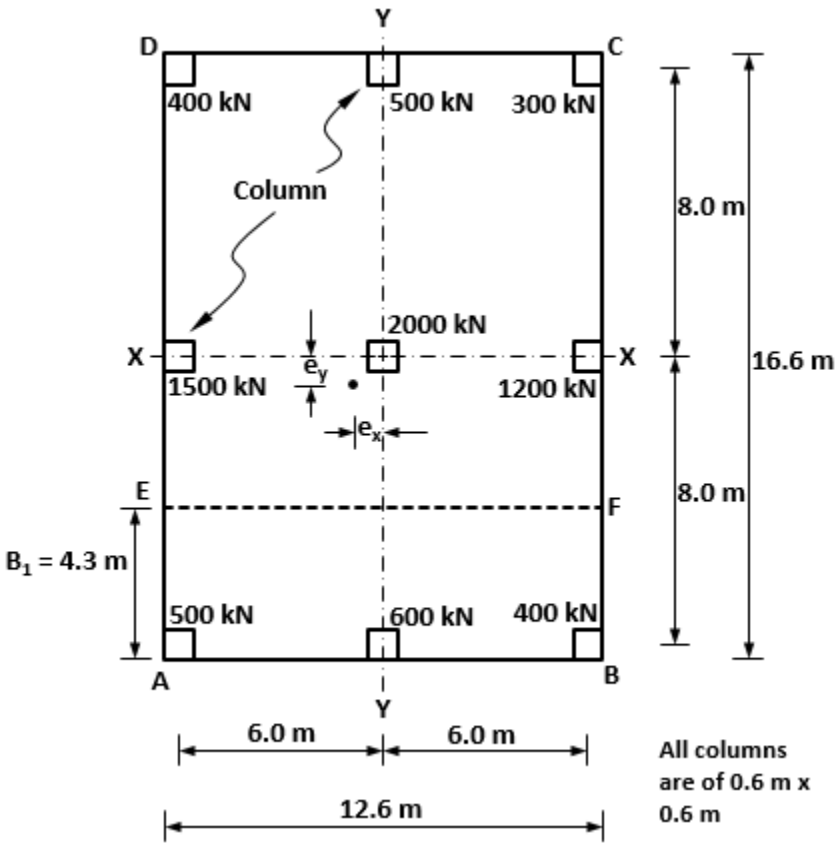

Figure Q3B

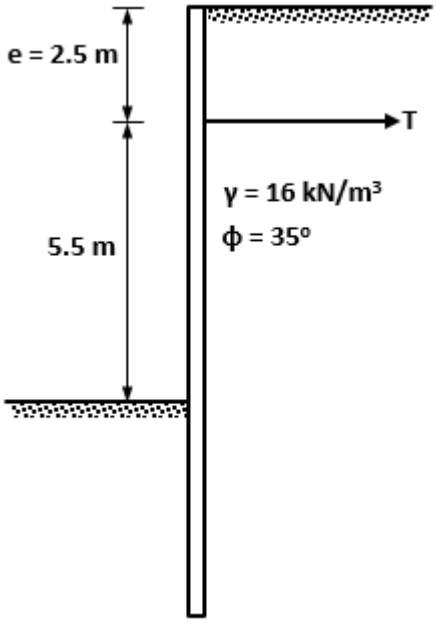

Figure Q4A

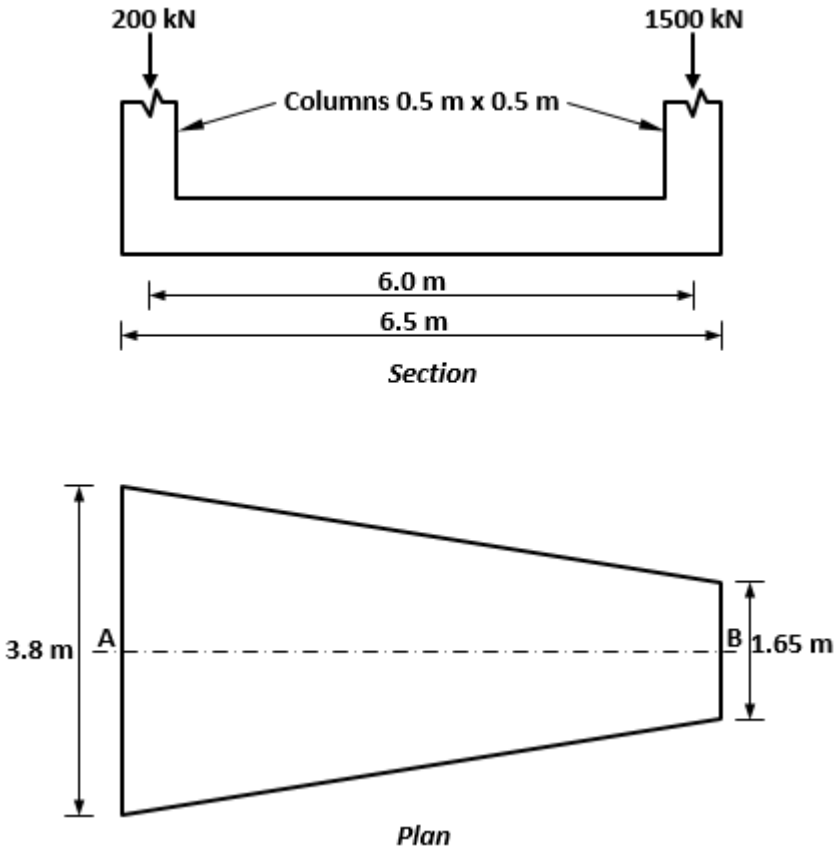

Figure Q4B

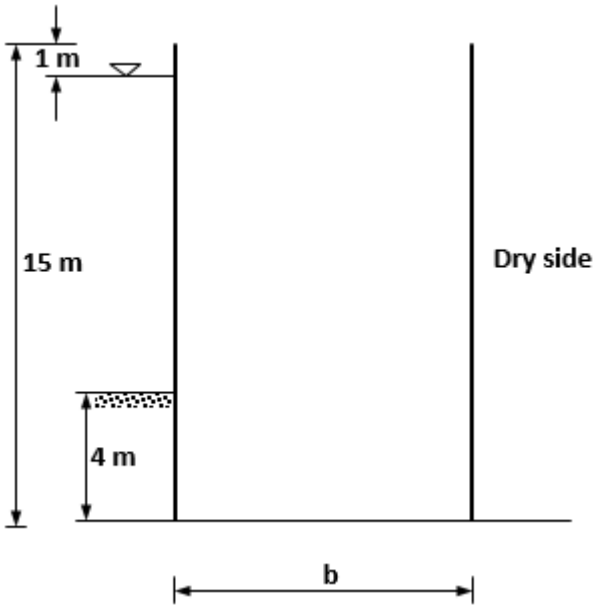

Figure Q5A

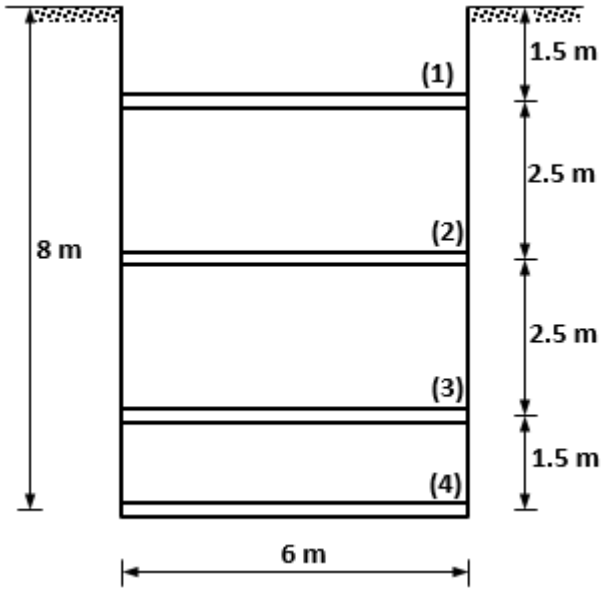

Figure Q5B