



(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

(Main Campus)

UNIVERSITY EXAMINATIONS

2019/2020 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER EXAMINATIONS

FOR THE DEGREE OF

BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING

COURSE CODE: CSE 421

COURSE TITLE: FOUNDATION ENGINEERING

DATE: TUESDAY 14TH JANUARY 2020 TIME: 12.00 – 2.00 PM

Instructions to Candidates

- This paper contains FOUR (4) questions
- Answer ALL questions in Section A and ANY TWO (2) in Section B

MMUST observes ZERO tolerance to examination cheating

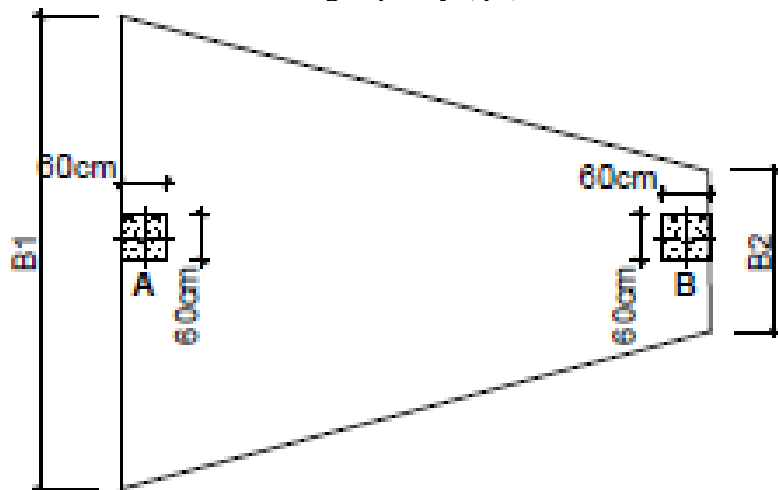
This Paper Consists of 4 Printed Pages. Please Turn Over →

SECTION A: Answer ALL questions [30 Marks]**Question One**

- a) Explain limitations of shallow foundations. [4 Marks]
- b) State assumptions of Terzaghi bearing capacity Theory and explain how Meyerhof theory addressed this limitations [3 Marks]
- c) Illustrate circumstances under which you will recommend the following types of foundations
 - i. Isolated Pad footing [2 Marks]
 - ii. Rectangular Combined footing [3 Marks]
 - iii. Trapezoidal Combined footing [3 Marks]
 - iv. Strap Footing [4 Marks]
 - v. Raft Foundation [4 Marks]
 - vi. Pile Foundation [3 Marks]
- d) A raft foundation is to be designed for a 36m*60m building with a total loading of $2.5 \times 10^5 \text{kN}$. The density of clay soil is 1840kg/m^3 . What should be the raft depth, D_f , for full compensation? [4 Marks]

SECTION B (Answer TWO questions)**Question two**

Find the Dimensions of the trapezoidal combined footing for the columns A and B that spaced 4.0m center to center, column A is 60cm x 60cm carrying dead loads of 700kN and 400kN live load and column B is 60cm x 60cm carrying 450kN dead load and 200kN live loads. Allowable net bearing capacity $(q_{all})_{net} = 200 \text{kN/m}^2$ [20 Marks].

**Fig Q2**

Question Three

For the shown mat foundation (fig.Q3), If the soil allowable net bearing capacity $q_{all,net}=100$ kN/m² and the loads on columns and their dimensions are given in the table below. Check the adequacy of the foundation dimensions. [20 Marks]

	Interior Columns	Edge Columns	Corner Columns
Column Dimensions	60cm X 40cm	60cm X 40cm	60cm X 40cm
Dead Loads	1200kN	700kN	400kN
Live Loads	600kN	500kN	200kN

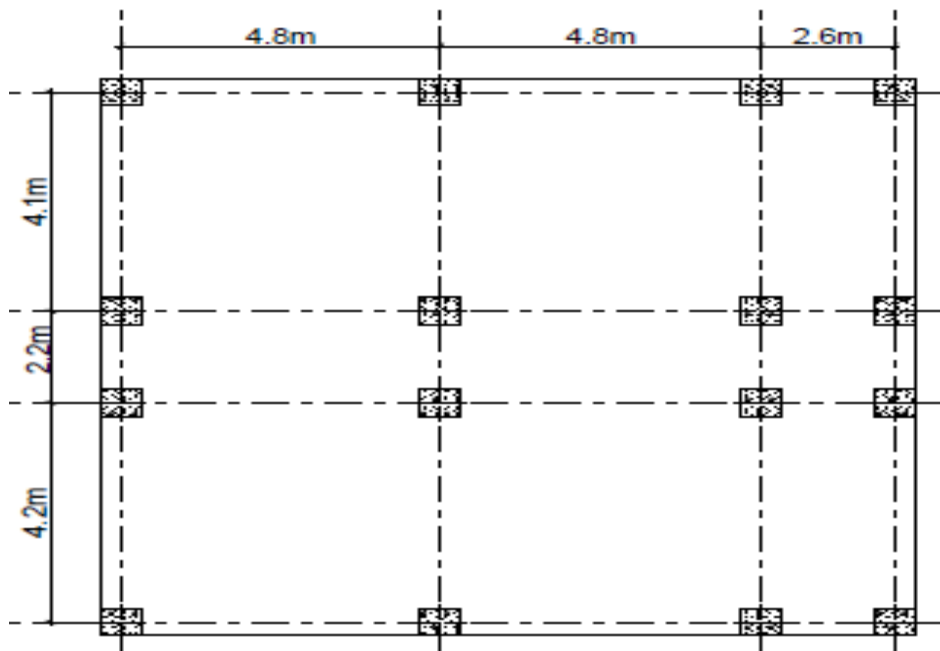


Fig Q3

Question Four

Determine the dimensions of a strap footing to support two columns that are spaced 4.4m center to center. The exterior column is 60 cm X 60 cm carrying 2000kN load and interior column is 70cm X 70cm carrying 2600kN load. The soil has a net allowable bearing pressure 300kN/m².

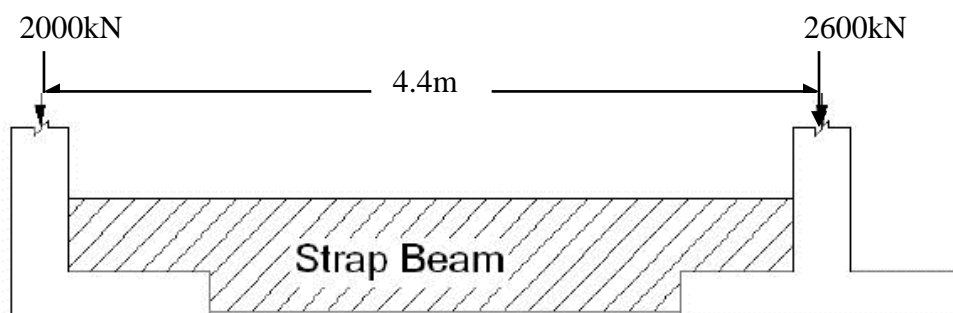


Fig Q4

EQUATIONS SHEET

$$1. \quad q_{\max} = \frac{R}{B \times L} \left(1 + \frac{6e}{L} \right) \quad q_{\min} = \frac{R}{B \times L} \left(1 - \frac{6e}{L} \right)$$

$$2. \quad \bar{X} = \frac{L}{3} \left(\frac{B_1 + 2B_2}{B_1 + B_2} \right)$$

$$3. \quad \Delta\sigma = \frac{P}{A} - \gamma D_f$$

$$4. \quad q = \frac{\sum Q_i}{A_{mat}} \pm \frac{M_y}{I_y} X \pm \frac{M_x}{I_x} Y$$