(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS 2022/2023 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE
OF
BACHELOR OF TECHNOLOGY IN BUILDING CONSTRUTION

COURSE CODE: BTB 412

COURSE TITLE: STRUCTURAL DESIGN III

**DATE:** 27TH APRIL 2023   **TIME: 8 – 10 A.M**

INSTRUCTIONS:

1. This paper contains FOUR questions
2. **Question ONE (1) is Compulsory**
3. **Attempt a total of THREE questions in this booklet.**
4. Marks for each question are indicated in the parenthesis.
5. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

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

Question 1   COMPULSORY   (20 marks)

a) Considering the floor plan shown in Figure Q1, with the one-way and two-way Spanning slabs indicated, determine the type and magnitude of the loading on each of the supporting beams. The slabs are assumed to be carrying a uniformly distributed design load of 5 kN/m². **(10 Marks)**
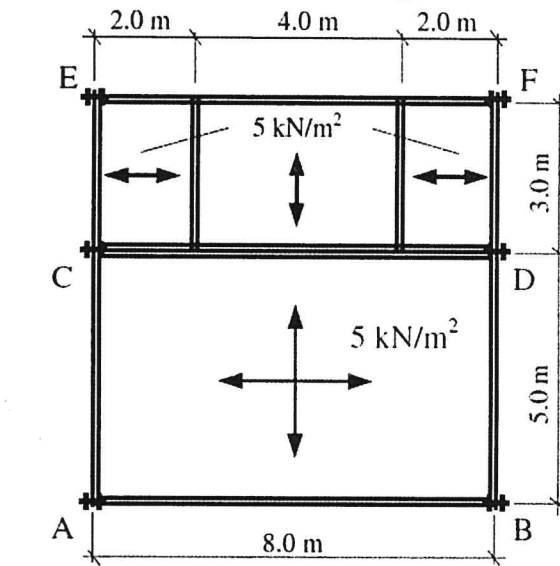
Figure, Q1

b) Explain factors to consider in choosing a bridge type. **(4Marks)**

c) Distinguish between Convetional design and Engineered design. Explain factors that necessitates engineered Design. **(6 Marks)**

Question 2   (20 marks)

A floor system consisting of a solid in-situ reinforced concrete slab cast integrally with the support beams is supported over four spans of 6.0 m as shown in Figure Q2. using the design data provided;

a) design suitable slab reinforcement, **(10 Marks)**

b) Check the suitability of the slab with respect to shear and deflection, **(5 marks)**

c) Prepare a sketch indicating all reinforcement; use the simplified rules indicated in BS8110: Part 1: Clause 3.12.10 **(5Marks).**

Design Data:

Characteristic dead load (excluding self-weight + finishes) g_k = 12.0 kN/m²
Characteristic dead load due to finishes only   gk = 1.0 kN/m²
Characteristic imposed load q_k = 5.0 kN/m²
Concrete grade   fcu = 40 N/mm²
Characteristic strength of reinforcing steel f_y = 460 N/mm²
Exposure condition = severe
Fire resistance = 1hr minimum
Slab thickness hf = 300 mm
Rib width bw = 300 mm

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Overall depth h = 600 mm
Span of main beams L = 6.0 m
Centres of main beams = 4.0 m

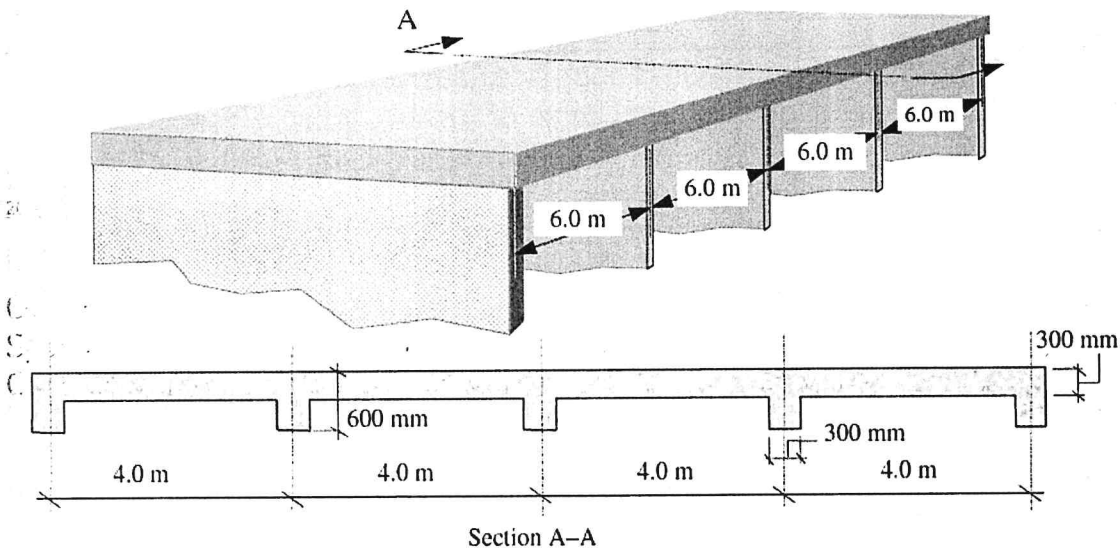**Figure Q2**

Question 3   (20 marks)

A pad foundation is required to support a single square column transferring an axial load only. Using the data provided:

a) Determine a suitable base size, (**3 marks**)
b) Check the base with respect to:
      i.   bending and Design suitable reinforcements **(7 marks)**
      ii.   direct shear (**5 Marks**)
      iii. punching shear **(5 marks)**

Design Data:
Characteristic dead load on column 800 kN
Characteristic imposed load on column 300 kN
Characteristic concrete strength f_{cu} = 40 N/mm^2
Characteristic of reinforcement f_y = 460 N/mm^2
Net permissible ground bearing pressure p_g = 200 kN/m^2
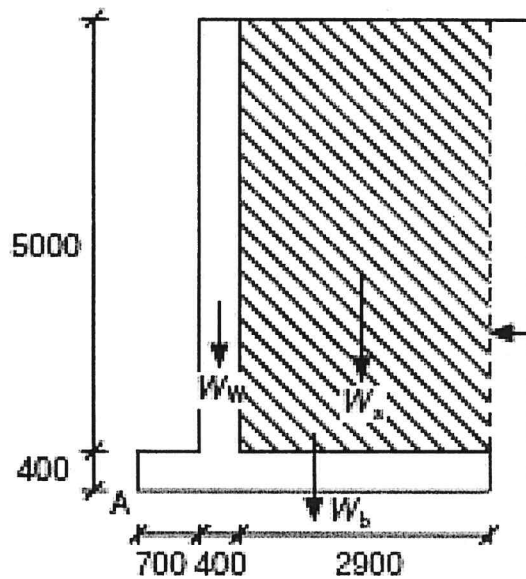Column dimensions 375 mm × 375 mm
Exposure condition severe

Question 4   (20 marks)

The cantilever retaining wall shown Fig Q4 is backfilled with granular material having a unit weight, ρ, of 19 kNm^{-3} and an internal angle of friction, φ, of 27°. Assuming that the allowable bearing pressure of the soil is 120 kNm^{-2}, the coefficient of friction is 0.4 and the unit weight of reinforced concrete is 24 kNm^{-3}

   a) Determine the factors of safety against sliding and overturning. **(6Marks)**
   b) Calculate ground bearing pressures. **(4 Marks)**
   c) Design the wall and base reinforcement assuming f_{cu} = 30 kNm-2, f_y = 460 kNm^{-2} and the cover to reinforcement in the wall and base are, respectively, 35 mm and 50 mm. **(10 Marks)**

Figure, Q4

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