



(UNIVERSITY OF CHOICE)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

UNIVERSITY MAIN EXAMINATIONS

2023/2024 ACADEMIC YEAR

**FOURTH YEAR FIRST SEMESTER EXAMINATIONS
FOR THE DEGREE OF BACHELOR OF TECHNOLOGY
IN
BUILDING CONSTRUCTION**

COURSE CODE: BTB 411

COURSE TITLE: STRUCTURAL DESIGN II

DATE: 7TH DECEMBER 2023

TIME: 8 A.M - 10 A.M

Instructions to Candidates

- This paper contains FOUR (4) questions
- Answer Question **ONE** and **ANY TWO** (2) questions
- Design codes are allowed

MMUST observes ZERO tolerance to examination cheating

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

Question One: 30 MARKS (COMPULSORY)

The floor shown in Fig Q1 has an overall depth of 150 mm is to be designed to carry an imposed load of 3 kN m^{-2} plus floor finishes and ceiling loads of 2 kN m^{-2} . Calculate the design loads acting on beams B1–C1, B2–C2 and B1–B3 and columns B1 and C1. Assume that all the column heights are 3.0 m and that the beam and column weights are 80 and 60 kg m^{-1} run respectively. **(30Marks)**

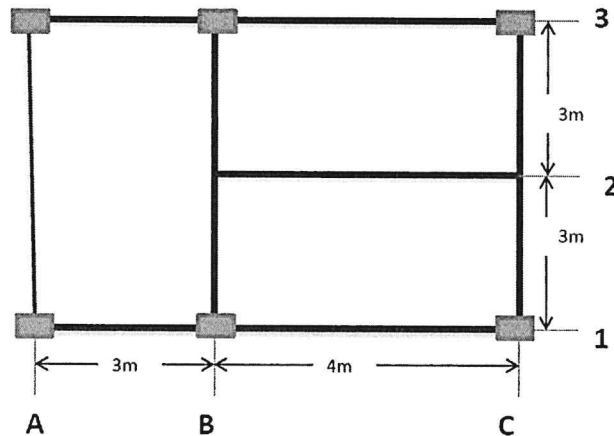


Fig Q1

Question Two: 20 MARKS

Reinforced concrete floor subject to an imposed load of 4 kNm^{-2} spans between brick walls as shown in Fig. Q2.

- a) Design the floor for mild exposure condition and One hour fire resistance assuming the following material strengths:

$f_{cu} = 35 \text{ Nmm}^{-2}$

$f_y = 500 \text{ Nmm}^{-2}$.

(14 Marks)

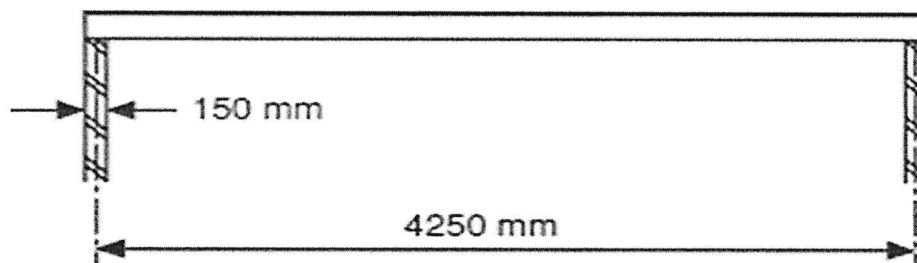


Fig Q2

- b) Prepare a sketch of reinforcement Details for the slab **(6 Marks)**

Question Three: 20 MARKS

A short, braced column is subjected to an ultimate applied axial load of 3000 kN and a nominal moment only. Using the design data given design the beam and sketch reinforcement Details (20 Marks)

Design Data

- Characteristic strength of concrete $f_{cu} = 40 \text{ N/mm}^2$
- Characteristic strength of reinforcing steel $f_y = 460 \text{ N/mm}^2$
- Width of column $b = 350 \text{ mm}$
- Depth of column $h = 375 \text{ mm}$
- End condition at the top of the column for x-x axis = 1
- End condition at the top of the column for y-y axis = 2
- End condition at the bottom of the column for x-x axis = 3
- End condition at the bottom of the column for y-y axis = 3
- Clear height between the end restraints about both axes = 5.0 m.

Question FOUR: 20 MARKS

- a) The cross-section of a simply supported rectangular beam is shown in Figure Figure Q 4(a). Using the data given, determine the maximum ultimate moment which can be applied to the section assuming it to be singly-reinforced. (10 Marks)

Design Data:

Characteristic strength of concrete (f_{cu})	30 N/mm ²
Characteristic strength of steel (f_y)	460 N/mm ²
Nominal maximum aggregate size (h_{agg})	20 mm
Diameter of main tension steel	32 mm
Diameter of shear links	8 mm
Exposure condition	mild
Minimum required fire resistance	1.0 hour

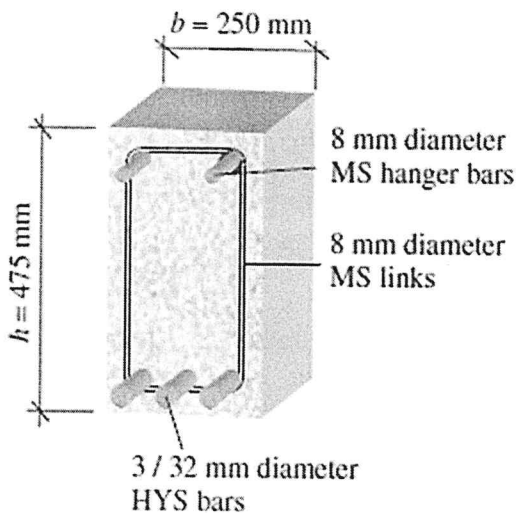


Figure Q4(a)

- b) A concrete beam is simply supported over a 5.0 m span as shown in Figure Q4(b). Using the data given, determine suitable shear reinforcement. **(10 Marks)**

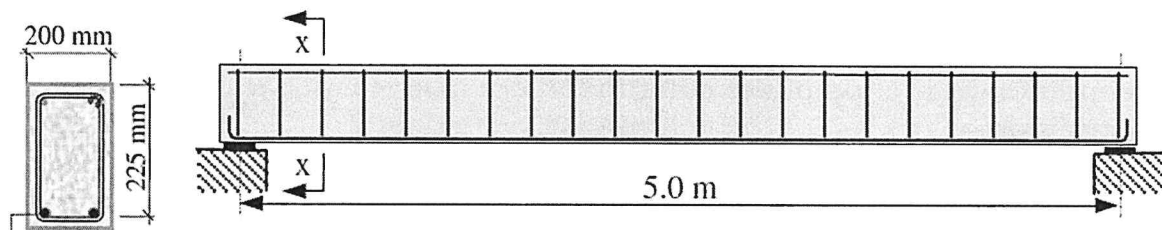
Design Data:

Characteristic strength of concrete (f_{cu}) 30 N/mm²

Characteristic strength of mild steel (f_{yv}) 250 N/mm²

Maximum shear force at the support 50 kN

Section x-x



2 / 16 mm HYS bars

Fig Q(4b)