



(University of Choice)
MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY
(MMUST) MAIN CAMPUS

2021/2022 ACADEMIC YEAR

THIRD YEAR FIRST SEMESTER EXAMINATIONS
FOR DEGREE IN **BUILDING AND CONSTRUCTION**

COURSE CODE: BTB 316

COURSE TITLE: **STRUCTURAL DESIGN I**

DATE: **FRIDAY 29TH APRIL 2022**

TIME: **3.00 – 5.00 PM**

INSTRUCTIONS :

1. Answer **THREE** Questions
2. Marks for each question are indicated in the parenthesis.
3. Steel and Timber Design Manuals are allowed
4. Examination duration is **2 Hours**

MMUST observes **ZERO** tolerance to examination cheating
This Paper Consists of 2 Printed Pages. Please Turn Over.

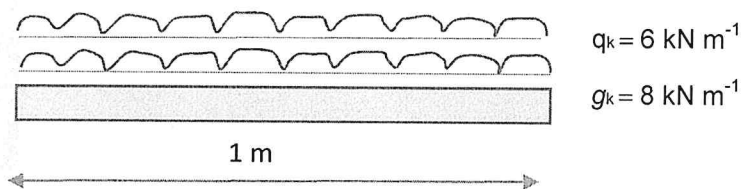
QUESTION 1 (25 MARKS)

A C22 timber connection has a 4.8mm Nail diameter by 65mm length of ordinary round nail. Both the head side and point side are 45mm in depth and the nail penetration to the point side is 20mm

- Idealize the case above and draw and name as illustrated above. (2marks)
- State four factors that the strength of the nail joint depends on (4 marks)
- Calculate the dry medium term lateral load for two (2) nails in single shear. (10 marks)
- Calculate the dry medium lateral load considering a case of double shear with other properties in (a) remaining the same. (9 marks)

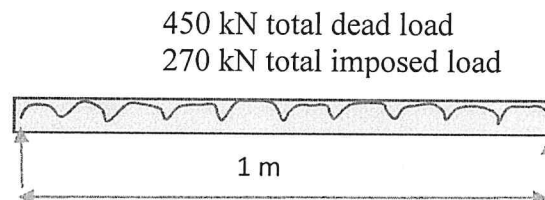
QUESTION 2 (25 MARKS)

Check the suitability of $356 \times 171 \times 51 \text{ kg m}^{-1}$ UB section in S275 steel loaded by uniformly distributed loading $g_k = 8 \text{ kN m}^{-1}$ and $q_k = 6 \text{ kN m}^{-1}$ as shown below. Assume that the beam is fully laterally restrained and that the beam sits on 100 mm bearings at each end. Ignore self-weight of beam.



QUESTION 4 (25 MARKS)

A proposed cantilever beam 1 m long is to be built into a concrete wall as shown. It supports characteristic dead and imposed loading of 450 kN/m and 270 kN/m respectively. Select a suitable UB section in S275 steel to satisfy bending and shear criteria only.



QUESTION 5 (25 MARKS)

A timber column of whitewood GS grade consists of a 150 mm square section which is restrained at both ends in position but not in direction. Assuming that the actual height of the column is 4 m, calculate the maximum axial long-term load that the column can support.

Consider;

GRADE STRESSES AND MODULUS OF ELASTICITY

Grade GS redwood belongs to strength class C22. Values in N/mm^2 are as follows

Compression parallel to grain N/mm^2	Bending parallel to grain N/mm^2	Shear parallel to grain N/mm^2	Modulus of elasticity E_{\min} N/mm^2
7.5	6.8	0.71	6500