



**MASINDE MULIRO UNIVERSITY OF  
SCIENCE AND TECHNOLOGY  
(MMUST)**

**MAIN CAMPUS**

**UNIVERSITY EXAMINATIONS  
2019/2020 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER EXAMINATIONS**

**FOR THE DEGREE  
OF  
BACHELOR OF TECHNOLOGY IN BUILDING CONSTRUCTION**

**COURSE CODE: BTB 342**

**COURSE TITLE: STRUCTURAL DESIGN I**

**DATE: WEDNESDAY 11<sup>TH</sup> NOVEMBER 2020 TIME: 9.00 – 11.00 AM**

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**INSTRUCTIONS:**

1. QUESTION ONE IS COMPULSORY
2. Attempt any other THREE questions
3. Marks for each question are indicated in the parenthesis.

Examination duration is **2 Hour**

MMUST observes ZERO tolerance to examination cheating

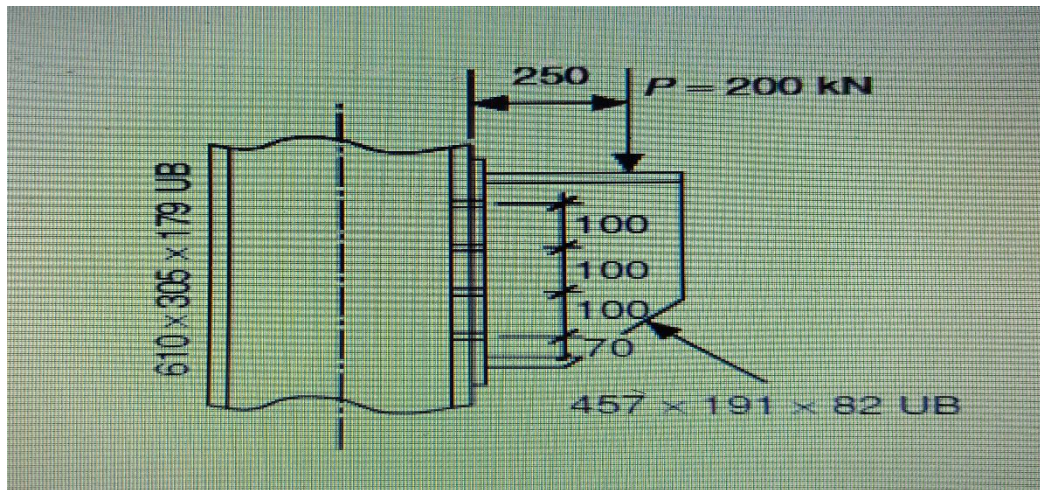
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**QUESTION 1 (25 MARKS)**

- Name five defects in timber that would make it unsuitable for use (5 mks)
- Timber as an engineering material is unique in its structure and mode of growth that result in characteristics and properties distinct and complex from other materials. Name some of these characteristics that influence design of timber. (5 mks)
- Most of engineering materials obeys Hooke's Law, i.e. when subjected to an external force system. With the aid of a diagram illustrate a typical stress-strain curve for a steel specimen. (10 mks)
- Name at least FIVE principal considerations in the design of all beams (5mks):

**QUESTION 2 (25 MARKS)**

- Name two types of steel material you know in the construction market (5mks)
- Name five disadvantages of steel as an engineering material (5mks)
- Figure 1 below is a steel bracket-to-column connection. Show that the bolts in the bracket-to-column connection below are suitable to resist the design shear force of 200 kN. Assume the bolts are all M16, grade 8.8. (15mks)

*Figure 1***QUESTION 3 (25 MARKS)**

- Timber is a hygroscopic material that absorbs/releases moisture from/to its surrounding environment depending on the amount of moisture in that environment. For exposure conditions three service classes have been defined. Explain the classes. (9 mks)
- With aid of diagrams, discuss 4 (Five) common modes of failure associated with steel beams and joists. (16 mks)

**QUESTION 4 (25 MARKS)**

Consider the design of a suspended timber floor system in a domestic building in which the joists at 500 mm centres are simply supported by timber beams on load-bearing brickwork, as shown in Fig (a). The support beams are notched at the location of the wall, as shown. Check for Bending and deflection of T&G member.

**Design data:**

Centre of timber joists 500 mm

Distance between the centre-lines of the brickwork wall 4.5 m

Strength class of timber for joists and tongue and groove boarding and beams C22

Imposed loading (long-term)  $3.0 \text{ kN/m}^2$

Exposure condition Service Class 1

BTB 342 STRUCTURAL DESIGN I

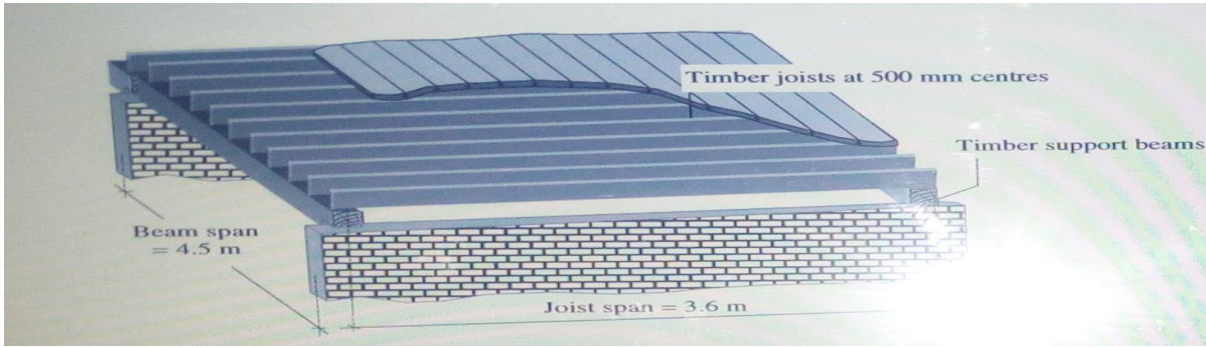


Figure 2

**QUESTION 5 (25 MARKS)**

Select a suitable column section in S275 steel to support the ultimate loads from beams A and B shown in Fig. 3. Assume the column is 7 m long and is effectively held in position at both ends but only restrained in direction at the bottom.

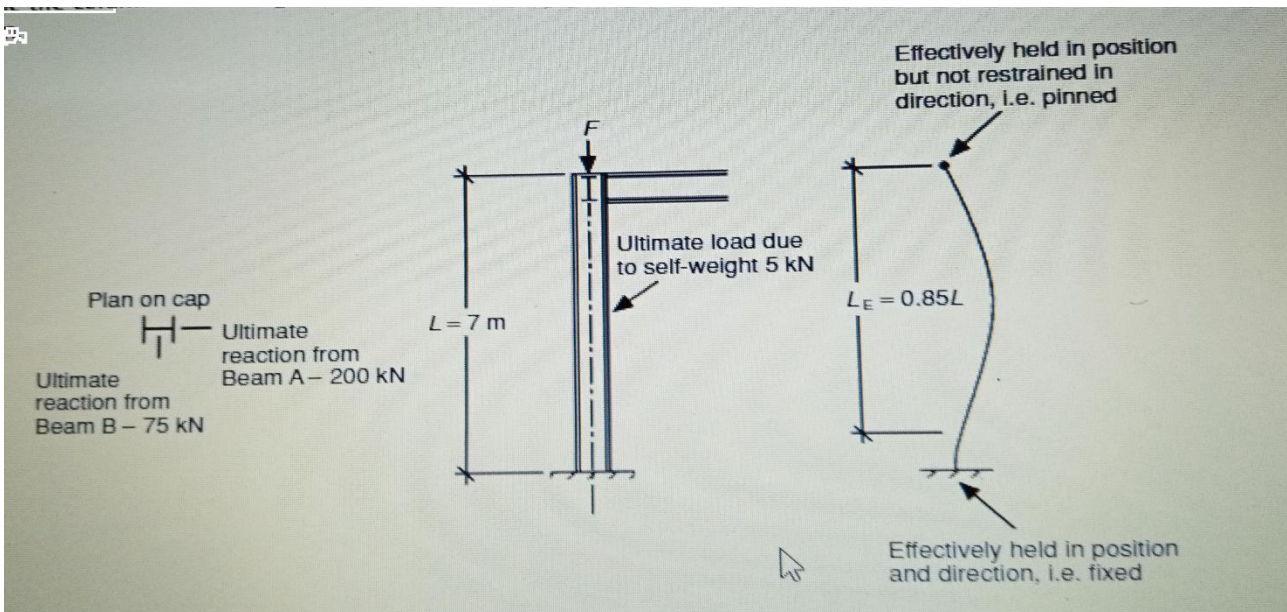


Figure 3