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(University of Choice)

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

MAIN CAMPUS

**UNIVERSITY SPECIAL/SUPPLEMENTARY
EXAMINATIONS
2021/2022 ACADEMIC YEAR**

THIRD YEAR SECOND SEMESTER EXAMINATIONS

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

COURSE CODE: BTB 316

COURSE TITLE: STRUCTURAL DESIGN I

DATE: 5TH AUGUST 2022

TIME: 2 HOURS

INSTRUCTIONS:

1. This paper contains FOUR Questions
2. Answer Question ONE and any other TWO Questions
3. Marks for each question are indicated in the parenthesis.
4. It is in the best interest of the student to write legibly
5. Examination duration is **2 Hours**

MMUST observes ZERO tolerance to examination cheating

This Paper Consists of 2 Printed Pages. Please Turn Over.

QUESTION ONE (Compulsory)

- a) Design a simply supported beam carrying a concrete floor slab over a span of 5.0 m in grade S275 steel. The unfactored dead load, which includes an allowance for self-weight, is 14 kN/m, and the ultimate unfactored imposed load is 19 kN/m. Assume web bearing and buckling is not critical [15 marks]
- b) Design a single angle for tension to carry a dead load of 70 kN and an imposed load of 35 kN. Use S275 grade steel and assume welded connection [6 marks]
- c) A 7.0 m long 152 x 152 x 30 UC in grade S275 steel is to be used as a strut with pinned ends and will carry axial load only. Determine its compression resistance. [9 marks]

QUESTION TWO

- a) Design the fillet weld for the direct shear connection for the angle loaded as shown in Figure Q2, where the load acts through the centroidal axis of the angle. The steel is Grade S275 [8 Marks]

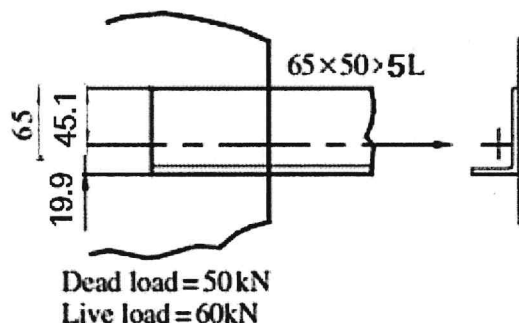


Figure Q2

- b) Determine the value of permissible bending stress parallel to grain and magnitude of maximum bending moment for a main beam of 50mm x 200 mm deep Canadian Douglas fir-larch grade SS under service class 3 and long duration loading. Also carry out deflection check [12 Marks]

QUESTION THREE

A 356 x 368 x 153 UC in grade S275 steel is part of a braced multi-storey frame which has been shown to be non-sway. The storey height between beam centres is 6.0 m. The column is attached to the beams using flush end plate connections and the beams support concrete floor slabs, thus providing partial restraint against bending in both principal planes and full restraint against rotation in plan. The axial load in the column is 1500 kN. At the upper end of the column segment the applied moment is 300 kNm about the major axis and 60 kNm about the minor axis. The corresponding values at the lower end are 200 kNm and 80 kNm respectively (as shown in the

bending moment diagrams in Figure Q3). Check the adequacy of the column section for this storey. [20 Marks]

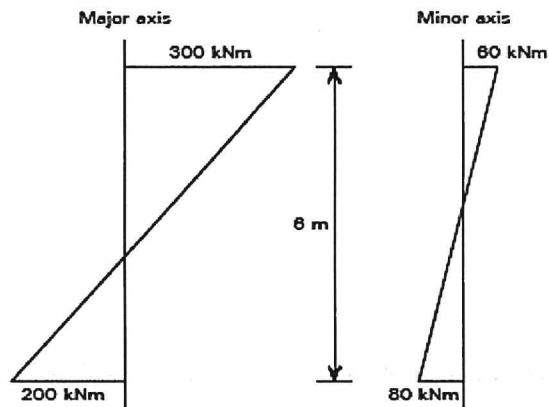


Figure Q3

QUESTION FOUR

A timber column in strength class C18 is 4 m in height with a rectangular cross-section of 97 mm x 145 mm. The column is fixed at both ends and is subjected to service class 1 conditions. Determine the maximum axial long-term load that the column can support [20 marks]

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