



MACHAKOS UNIVERSITY

University Examinations for 2020/2021 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 501: STRUCTURAL DESIGN III

DATE: 11/8/2021

TIME: 8.30-10.30 AM

INSTRUCTIONS

1. This paper comprises five questions. Answer three questions
2. Question one is **compulsory** and carry 30 marks
3. Answer any other **two** questions

QUESTION ONE (30 MARKS)

- a) List five functions of mortar in masonry construction (5 marks)
- b) A timber floor spanning 3.8 m centre to centre is to be designed using timber joists at 400 mm centres. The floor is subjected to a domestic imposed load of 1.5 kN/m^2 and carries a dead loading, including self-weight of 0.35 kN/m^2 . Carry out design checks to show that a series of 44 mm x 200 mm deep sawn section British spruce grade SS under service class 1 is suitable. (25 marks)

QUESTION TWO (20 MARKS)

The load bearing studs within a wall panel have a height of 2.75m and the studs are spaced at 600mm centre to centre with a mid-height noggin. The studs are 38mm x 89mm of timber grade C16 have been used for the studs. The wall functions in service class 1 conditions and supports a characteristic permanent action of 1.0 kN/m (inclusive of the panel self-weight) and a characteristic variable medium-term action of 9.0 kN/m . There is wall sheathing on one face and plasterboard on the other face which provide lateral restraint to the studs. Check that the wall studs are suitable under those conditions.

QUESTION THREE (20 MARKS)

A main beam spans over an effective length of 2.8 m and supports a flooring system which exerts a long-duration load of 4 kN/m, including its own self-weight, over its span. Carry out design checks to see if a 75 mm x 300 mm deep sawn section imported whitewood Grade SS under service Class 1 is suitable

QUESTION FOUR (20 MARKS)

A steel beam is supported by two masonry walls and carries a mid-span concentrated load from a stanchion in addition to a uniformly distributed load as shown in Fig. Q4. Using the data given, select an appropriate concrete block strength assuming a 1:3, masonry cement: sand mortar is to be used.

Design data:

Characteristic self-weight of walls	5.2 kN/m ²
Ultimate design load on the column	300kN
Ultimate design uniformly distributed load on the beam	30kN
Ultimate design load on the wall from above	100kN
Category of manufacturing control	special
Category of construction control	normal
Effective height of the wall	3.0m

Solid concrete blocks with a height to least horizontal dimension equal to 1.4 are to be used.

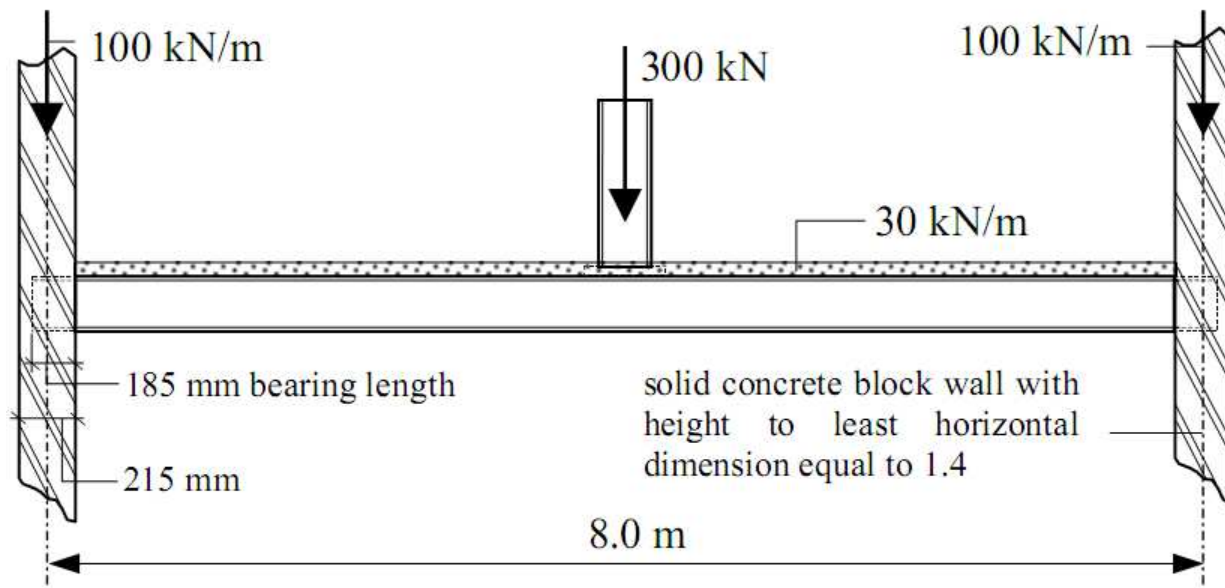


Fig.Q4

QUESTION FIVE (20 MARKS)

- a) List five factors that can affect the strength of timber once used in construction of structures.
(5 marks)
- b) A timber column of redwood GS grade consists of a 100 mm square section which is restrained at both ends in position but not in direction. Assuming that the actual height of the column is 3.75 m, calculate the maximum axial long-term load that the column can support.
(15 marks)