



MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 501: STRUCTURAL DESIGN III

DATE: 17TH JANUARY, 2025

TIME: 11.00 AM – 1.00 PM

INSTRUCTIONS:

Answer question **ONE (Compulsory)** and **any other TWO** questions

QUESTION ONE (COMPULSORY) (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)

A 150 mm thick reinforced concrete roof slab is supported on two single-leaf walls as shown in figure Q2. Using the design data provided determine a suitable structural unit/mortar combination for the wall using standard format bricks.

Design data:

Characteristic self-weight of concrete	24 kN/m^3
Self-weight of all walls	2.0 kN/m^2
Characteristic imposed load on roof slab	1.5 kN/m^2
Category of manufacturing control	normal
Category of construction control	normal

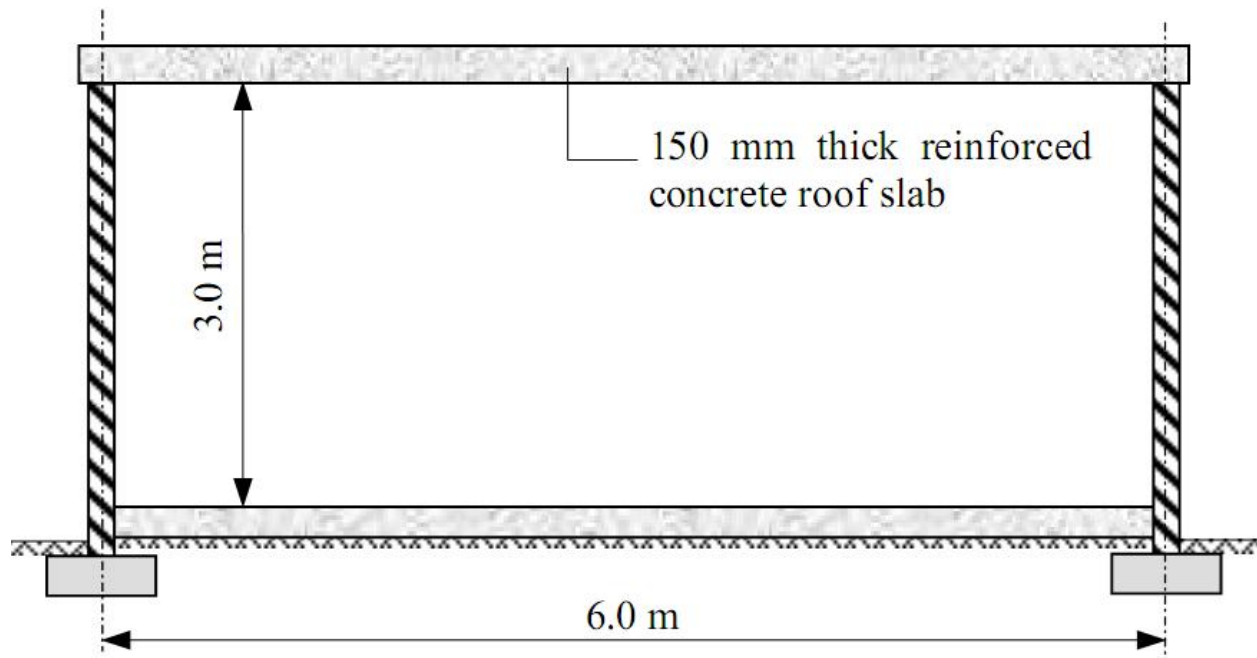


Figure Q2

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.

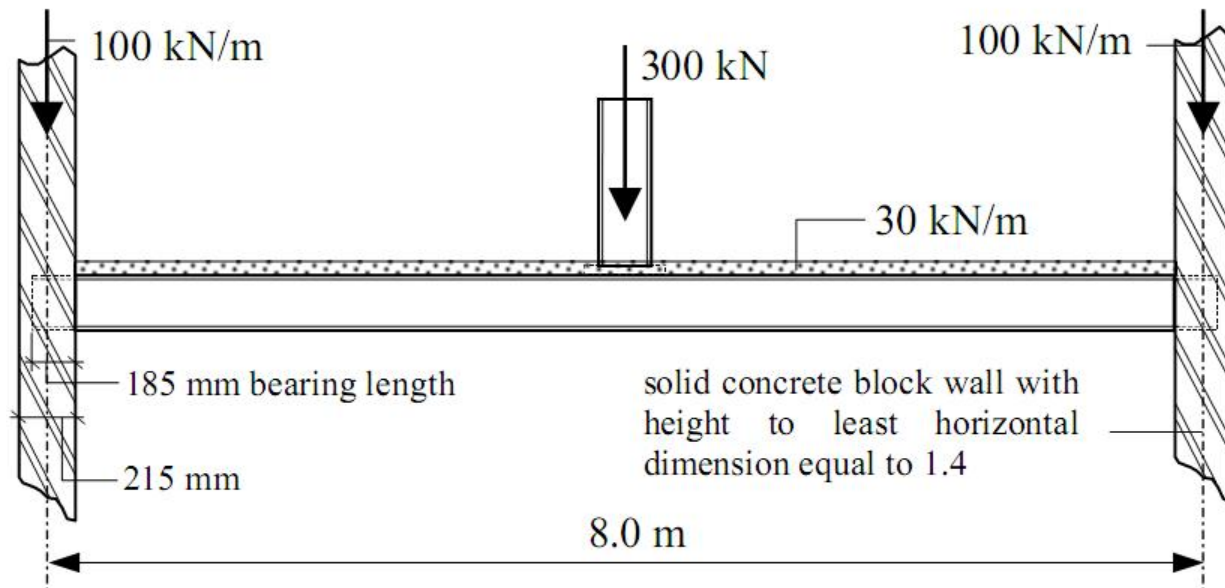


Fig.Q4

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)