MACHAKOS UNIVERSITY

University Examinations for 2021/2022 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: 29/8/2022 **TIME: 11.00-1.00 PM**

INSTRUCTIONS:

- *This paper comprises of FIVE questions. Answer **THREE** questions*
- *Question one is **compulsory** and carry 30 marks*
- *Answer any other **TWO** questions*

QUESTION ONE (30 MARKS)

a) Check the suitability of 72 x 220mm joists of strength C24 for use within a domestic floor in service class 2. The clear span is 2.8m and the trimmer supports incoming joists spaced at 0.6m centres. Dead load 0.35kN/m^2 inclusive of trimmer self-weight, imposed load 1.5kN/m^2. Incoming joists have a span of 4.2m. (15 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. (15 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 1.0kN/m (inclusive of the panel self-weight) and a characteristic variable medium-term action of 9.0kN/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 150 mm thick reinforced concrete roof slab is supported on two single-leaf walls as shown in Fig. Q4. 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	$24kN/m^3$
Self-weight of wall walls	$2.0kN/m^3$
Characteristic imposed load on roof slab	$1.5kN/m^3$
Category of manufacturing control	normal
Category of construction control	normal

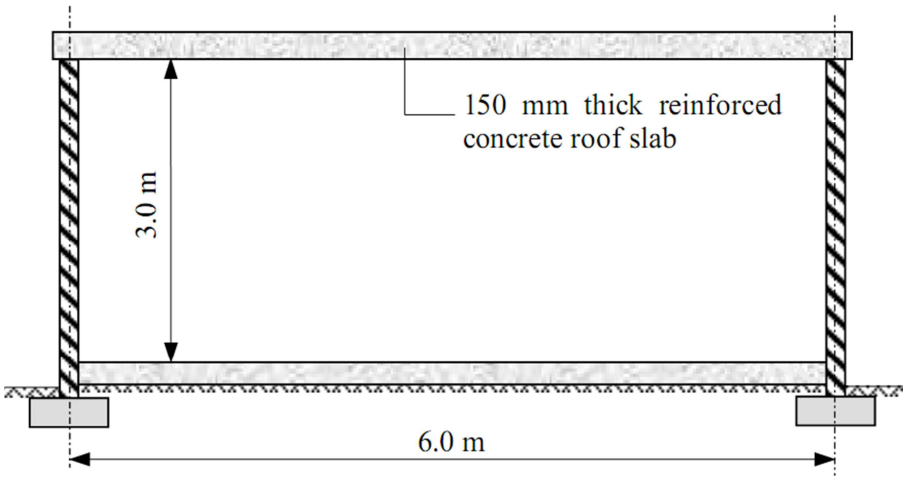

Fig.Q4

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)