



MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 412: STRUCTURAL DESIGN II

DATE: 11/11/2020

TIME: 8.30 -10.30 AM

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (30 MARKS)

Figure Q1 shows the plan of a residential building. Design and detail the slab in the panel A3- A4 to D3-D4, assuming the following data:

Slab thickness = 100mm

Live load = 2.4 kN/m^2

Floor finishes = 0.6 kN/m^2

Grade 20 concrete

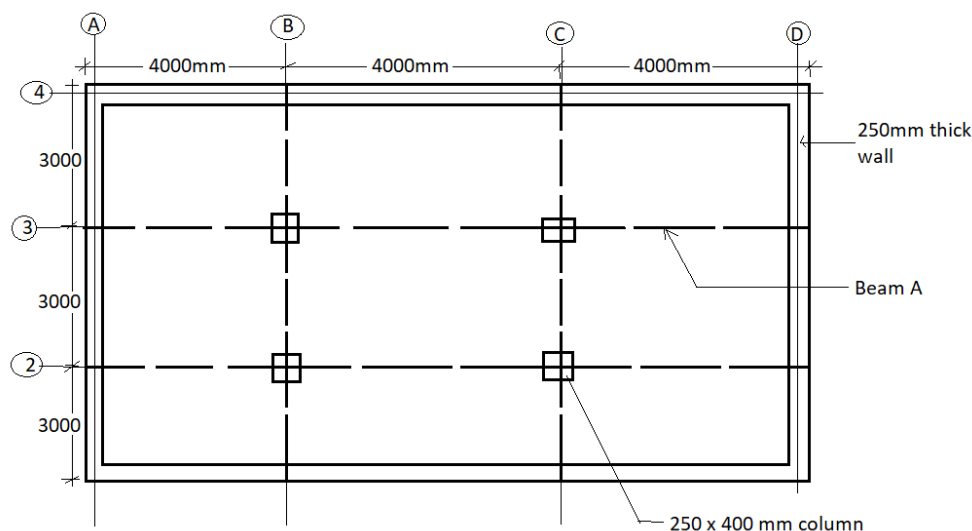


Figure Q1

QUESTION TWO (20 MARKS)

- a) Design the longitudinal steel and links for a 300 mm square reinforced concrete column, short-braced which is to carry an ultimate load of 1400 kN, with the following material properties; $f_{cu} = 25 \text{ N/mm}^2$ and $f_y = 460 \text{ N/mm}^2$. (14 marks)
- b) Clearly describe two ways that may be used to achieve pre-stressing in concrete construction. (6 marks)

QUESTION THREE (20 MARKS)

A solid footing has to transfer a dead load of 1000 kN and an imposed load of 400 kN from a square column 400 x 400 mm (with 16 mm bars). Assuming $f_y = 460$, and $f_{ck} = 20 \text{ N/mm}^2$, and safe bearing capacity to be 200 kN/m^2 , design the footing.

QUESTION FOUR (20 MARKS)

Figure Q4 shows a simply supported reinforced concrete beam carrying a uniformly distributed load of 80 kN/m. Design the beam, assuming that the beam has a width of 250 mm and a depth of 800 mm. The concrete grade is 25 with $f_y = 460 \text{ N/mm}^2$ and $f_{yv} = 250 \text{ N/mm}^2$.

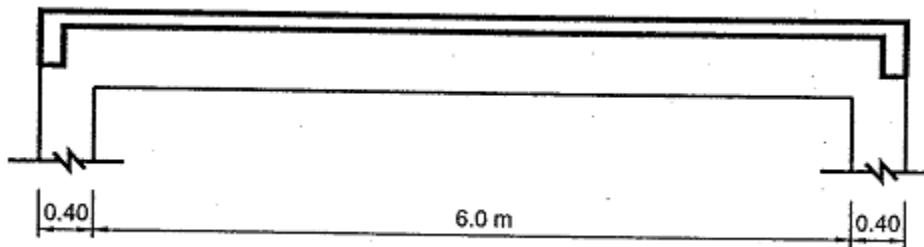


Figure Q4

QUESTION FIVE (20 MARKS)

Design the longitudinal and lateral reinforcement in a rectangular reinforced concrete column of size 300 mm by 400 mm subjected to a design ultimate load of 1200 kN and an ultimate moment of 200 kNm with respect to the major axis. Adopt C20 concrete and $f_y = 415 \text{ N/mm}^2$.