



TECHNICAL UNIVERSITY OF MOMBASA

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SCHOOL OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

**ECV 4412: STRUCTURAL DESIGN II**

END OF SEMESTER EXAMINATION

**SERIES: JANUARY 2025**

**TIME: 2 HOURS**

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **five** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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**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<sup>2</sup>

Floor finishes = 0.6kN/m<sup>2</sup>

Grade 20 concrete

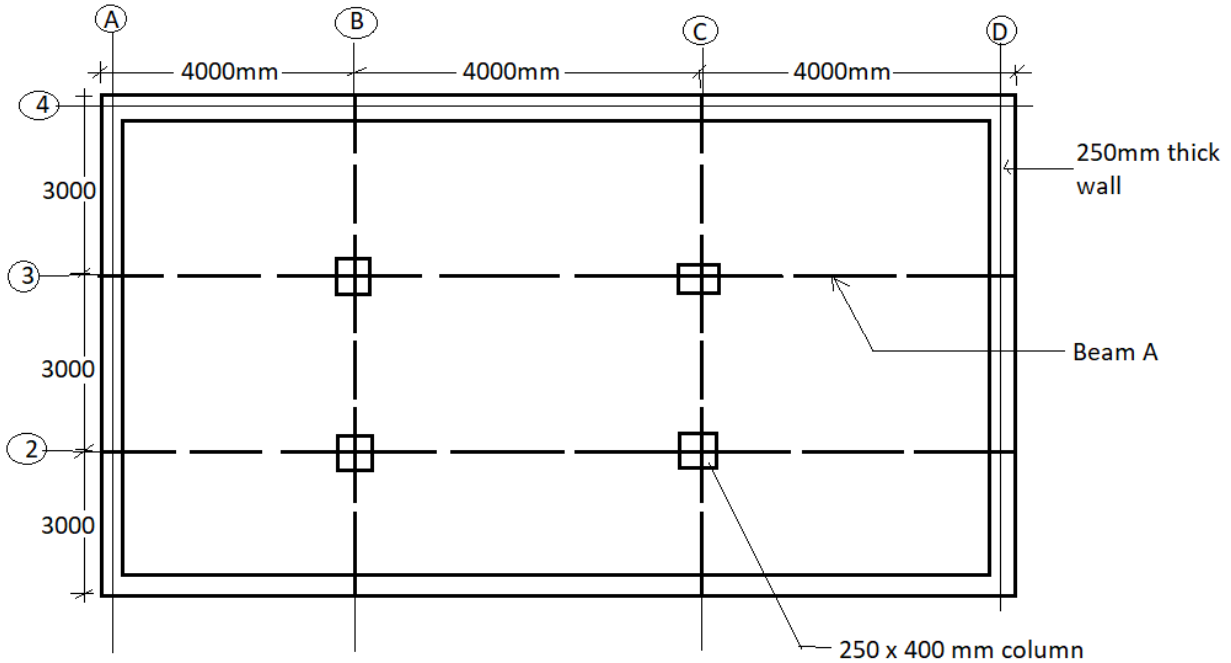


Figure Q1

### QUESTION TWO (20 Marks)

- (i) 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)**
- (ii) 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  $200 \text{ kN/m}^2$ , design the footing. **(20 Marks)**

### 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  $f_{yv} = 250 \text{ N/mm}^2$ .

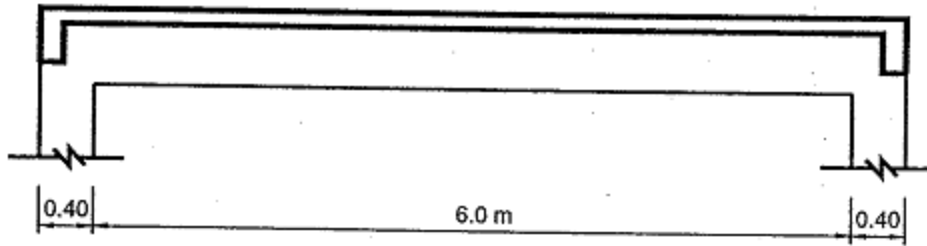


Figure Q4

**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  $f_y = 415 \text{ N/mm}^2$ .