MACHAKOS UNIVERSITY

University Examinations for 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR FIRST SEMESTER EXAMINATION

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 412 STRUCTURAL DESIGN II

DATE: **TIME:**

INSTRUCTIONS

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (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 = 0.6kN/m^2

Grade 20 concrete

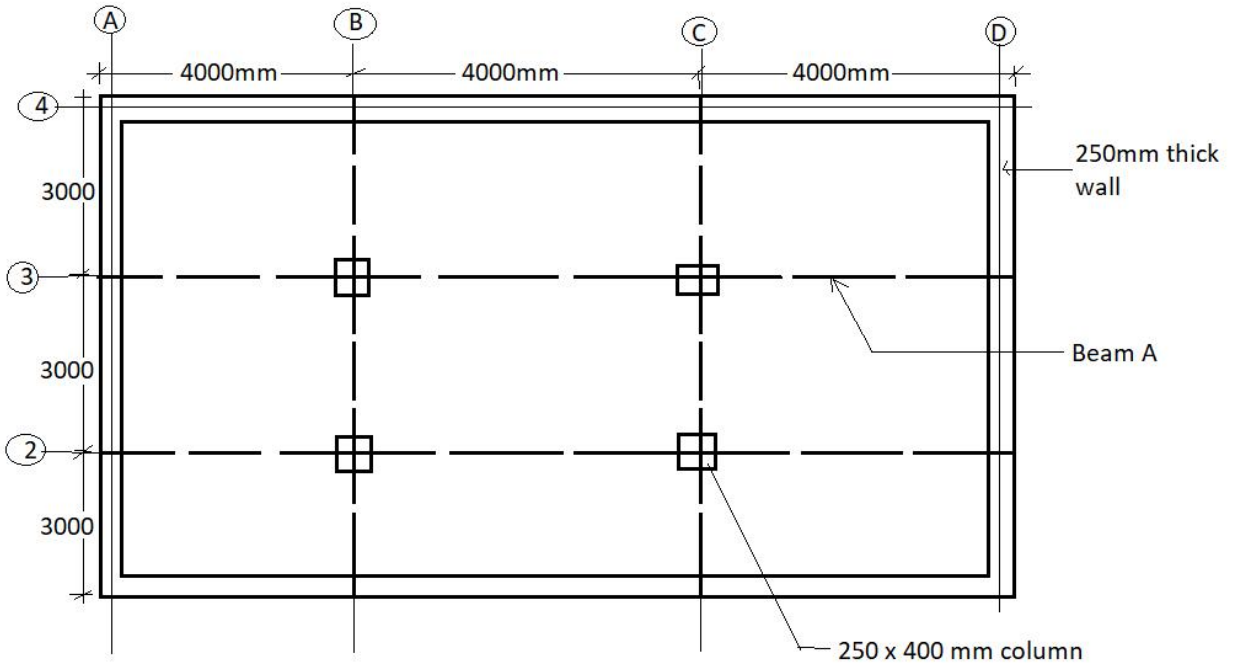

Figure Q1

QUESTION TWO (20 Marks)

a) State five serviceability limit states that may be considered during design. (5 marks)

b) Design the longitudinal and shear reinforcement for a 275mm square, short-braced column which supports an ultimate axial load of 1280 kN and bending moments of 35 kNm about the x-x axis and 25 kNm about the y-y axis. Assume f_{cu} = 30 N/mm^2 and f_y = 460 N/mm^2 and cover to all reinforcement is 35 mm. (15 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 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 fy = 460 N/mm2 and fyv = 250 N/mm^2.

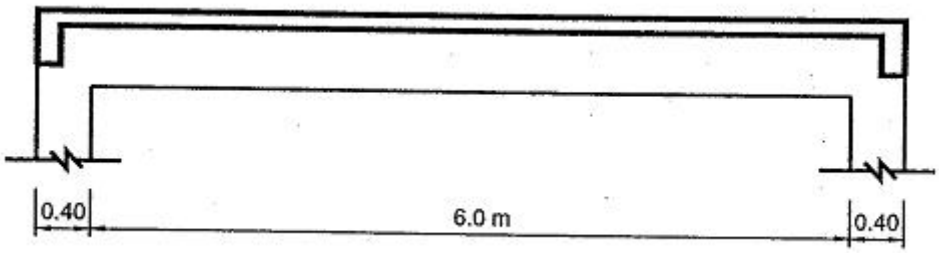

Figure Q4

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 fy = 415 N/mm^2.