TECHNICAL UNIVERSITY OF MOMBASA

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

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4412: STRUCTURAL DESIGN II

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 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.

QUESTION ONE (30 Marks)

(a) A reinforced concrete beam which is 300 mm and 600 mm deep is required to span 6 m between the centers of supporting piers of 300 mm wide. The beam carries a g_k and q_k of 25 kN/m and 19 kN/m respectively. Assume $f_{cu} = 30$ N/mm^2, $f_y = 460$ N/mm^2 and $f_{yv} = 250$ N/mm^2, and the exposure condition being mild; design the beam. (20 marks)

(b) Design the reinforcement in a circular column of diameter 300 mm to support a factored load of 1500 kN. The column has an unsupported height of 3 m and is braced against side sway. Adopt $f_{cu} = 20$ N/mm^2 and $f_y = 415$ N/mm^2. (10 Marks)

QUESTION TWO (20 Marks)

Design a reinforced concrete slab 6.3 m by 4.5 m simply supported on all four sides. It has to carry a characteristic live load of 10 kN/m^2 in addition to its dead weight. Assume grade 25 concrete and high yield steel; also assume that the exposure condition to environment can be classified as mild.

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 = 415N/mm^2, and f_{ck} = 20 N/mm^2, and safe bearing capacity to be 200 kN/m^2, design the footing.

QUESTION FOUR (20 Marks)

(a) 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)

(b) List five types of slabs that may be used in construction of reinforced concrete structures. (5 marks)

QUESTION FIVE (20 Marks)

A pre-tensioned beam has a pre-stress of 1500 kN in the steel immediately after pre-stressing which eventually reduces to 1250 kN. The beam carries two live loads of 40 kN each in addition to its own weight as shown in figure Q5. Compute the fiber stresses at mid-span

(a) Under initial condition
(b) At final condition

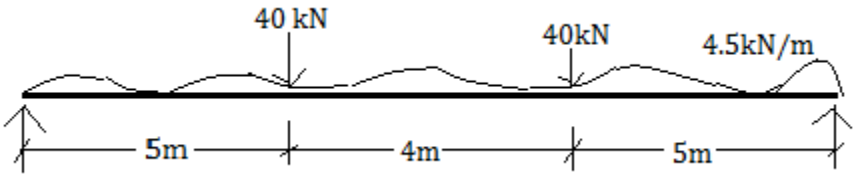

Figure Q5