



TECHNICAL UNIVERSITY OF MOMBASA

SCHOOL OF ENGINEERING AND TECHNOLOGY
Department of BUILDING & Civil engineering
UNIVERSITY EXAMINATION FOR:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4501: STRUCTURAL DESIGN III
SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: JULY 2025

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, calculator, examination pass and student ID

This paper consists of **five** questions.

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

Relevant design codes are allowed

QUESTION ONE (30 Marks)

Design a cantilever retaining wall to retain earth for a height of 4 m. The backfill is horizontal. The density of soil is 18 kN/m^3 . Safe bearing capacity of soil is 200 kN/m^2 . Take the co-efficient of friction between concrete and soil as 0.6 and the angle of response is 30 degree. Use grade 20 concrete and high tensile steel. (30 Marks)

QUESTION TWO (20 Marks)

Design the reinforcement required for a braced column against side sway with the following data:

Size of column = $350 \times 450 \text{ mm}$

Concrete grade 30 and steel 460 N/mm²

Effective lengths l_{ex} and l_{ey} = 7.0 and 6.0 m, respectively

Unsupported length l = 8m

Factored load = 1700kN

Factored moments in the direction of larger dimension = 70kNm at top and 30kNm at bottom

Factored moments in the direction of shorter dimension = 60kNm at top and 30 kNm at bottom.

The column is bent in double curvature and the reinforcement will be distributed equally on four sides. (20 Marks)

QUESTION THREE (20 Marks)

Briefly discuss the steps involved in planning for construction of a bridge in a newly proposed route. (20 Marks)

QUESTION FOUR (20 Marks)

Design a simply supported reinforced concrete bridge deck slab using a unit strip method. The deck carries a 100 mm depth of surfacing together with a normal HA live load uniformly distributed load of 17.5 kN/m² and knife edge load of 33 kN/m. The deck should also be designed to carry 30 units of HB load. The span of the deck is 12.0 m center to center of bearings.

QUESTION FIVE (20 Marks)

A microwave tower of 50m height is proposed over a hill top. The height of the hill is 50m with a gradient of 1 in 4. The terrain category is 3. The tower is proposed at a site with basic wind speed of 39m/sec. Compute the design wind pressure. (20 Marks)