



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

END OF SEMESTER EXAMINATION

SERIES: JANUARY 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.

Do not write on the question paper.

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/m³. Safe bearing capacity of soil is 200 kN/m³. Take the coefficient of friction between concrete and soil as 0.6 and the angle of response is 30 degree. Use grade 25 concrete and high tensile steel. (30 Marks)

QUESTION TWO (20 Marks)

- (a) Briefly discuss the HA and HB loading as applied to bridge engineering design. (8 Marks)
- (b) Briefly discuss the transportation, technical and architectural requirements that one should consider in allocating bridges in urban regions. (12 Marks)

QUESTION THREE (20 Marks)

Design the longitudinal steel for a braced column 500 x 400 mm bent in single curvature with $f_{cu} = 40 \text{ N/mm}^2$ and $f_y = 460 \text{ N/mm}^2$ and the following data: effective length about both axes = 6.5 m, unsupported length = 7m, factored load = 2500 kN, factored moments on major axis are 250 kNm at the top and 200 kNm at bottom. The factored moments about minor axis are 120 kNm at top and 100 kNm at the bottom. (20 Marks)

QUESTION FOUR (20 Marks)

Determine the loading that can be carried by 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/m^2 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 39 m/sec . Compute the design wind pressure. (20 Marks)