



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY DEPARTMENT OF BUILDING & CIVIL ENGINEERING UNIVERSITY EXAMINATION FOR: BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 4519 : STRUCTURAL DESIGN IV
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.

QUESTION ONE (COMPULSORY) (30 Marks)

The substitute frame of a multi-storeyed building having 3 bays has a continuous beam ABCD with $AB = 4.0$ m $BC = 2.5$ m and $CD = 4.0$ m. The beams are spaced at 3 m intervals. The thickness for floor slab = 120 mm. Live load (office floor) = 4 kN/m². Floor finish = 0.6 kN/m². Size of beams = 250 mm by 400 mm. Size of columns = 250 mm by 400 mm. Height between floors = 4m. Analyze the substitute frame and estimate the maximum design moments in the beams and columns.

QUESTION TWO (20 Marks)

Design a bridge with 2 No. 19m spans center to center of bearings. The bridge is 7.3m wide and has a carriage way with 2 No. 2m wide footways. It has a 125mm thick surfacing and it will carry an urban all-purpose single carriageway road.

QUESTION THREE (20 Marks)

The plan and elevation of a three-storey reinforced concrete school building is as shown in Figure Q3. The building is located in seismic zone V. The type of soil encountered is medium stiff and it is proposed to design the building with a steel special moment resisting frame. The intensity of dead load is 15 kN/m² and the floors are to cater for an imposed load of 3 kN/m². Determine the design seismic loads on the structure by static analysis. (20 Marks)

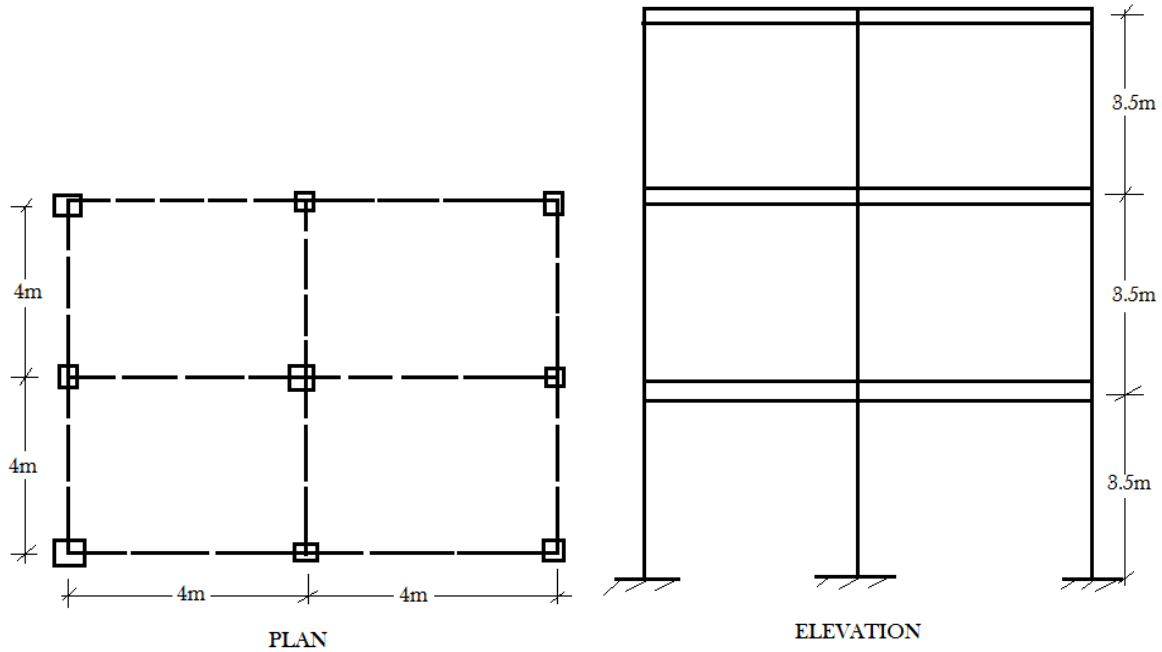


Figure Q3

QUESTION FOUR (20 Marks)

- Clearly discuss three seismic structural systems that are normally used in earthquake prone zones (9 Marks)
- Briefly discuss five construction techniques that have to be included when designing structures in order to reduce the intensity of earthquake energy on structures. (11 Marks)

QUESTION FIVE (20 Marks)

Analyze the building frame subjected to horizontal forces as shown in Figure Q5 by cantilever method assuming that all the columns have the same area of cross-section of 0.5m^2 . (20 Marks)

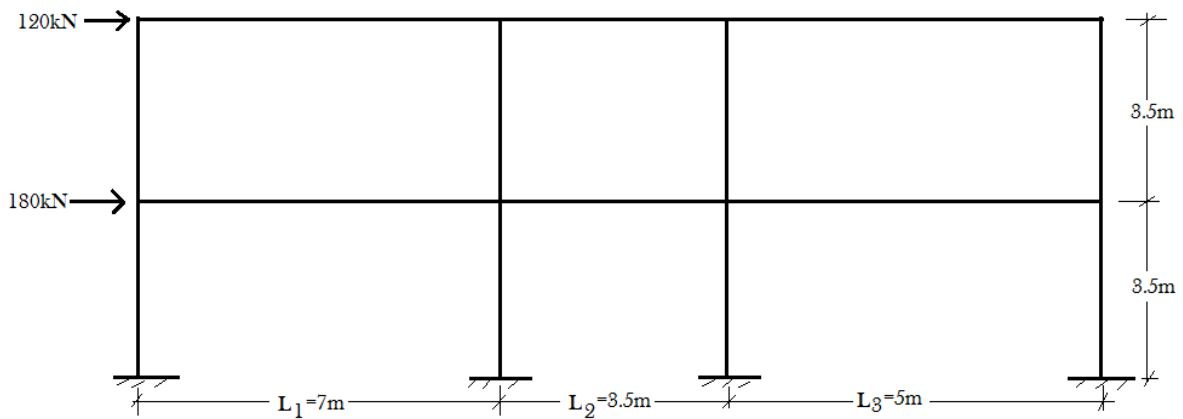


Figure Q5