



TECHNICAL UNIVERSITY OF MOMBASA

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

BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING
TCV 4316: STRUCTURAL STEEL DESIGN

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MARCH 2025

TIME: 2 HOURS

Instructions to Candidates:

1. You should have answer booklet for this examination.
2. This paper contains FOUR questions
3. Answers question **ONE** any other **TWO** questions.
4. Design assumptions are acceptable
5. Marks for each question are indicated in the parenthesis.
6. Examination duration is **2 Hours**

Question One (20 marks)

- (a) Using a sketch of a cantilever steel beam illustrate the Lateral torsional buckling failure. [6 marks]
- (b) Outline the steel Classification of cross-sections according EC 3 [4 marks]
- (c) List and discuss the factors that influence the load carrying capacity of steel columns [6 marks]
- (d) Outline why bolted connections are preferred in steel structures as compared to welded connections. [4 marks]

Question Two (20 marks)

A steel beam of $356 \times 171 \times 51$ kg/m UB section in S275 steel loaded by uniformly distributed loading $g_k = 7$ kN/m and $q_k = 6$ kN/m as shown in figure Q2 was used as the structural support system of a graduation pavilion at TUM. Assume that the beam is fully laterally restrained and that the beam sits on 100 mm bearings at each end. Check the suitability of the section to support the loading without failure.



Ignore self-weight of beam.

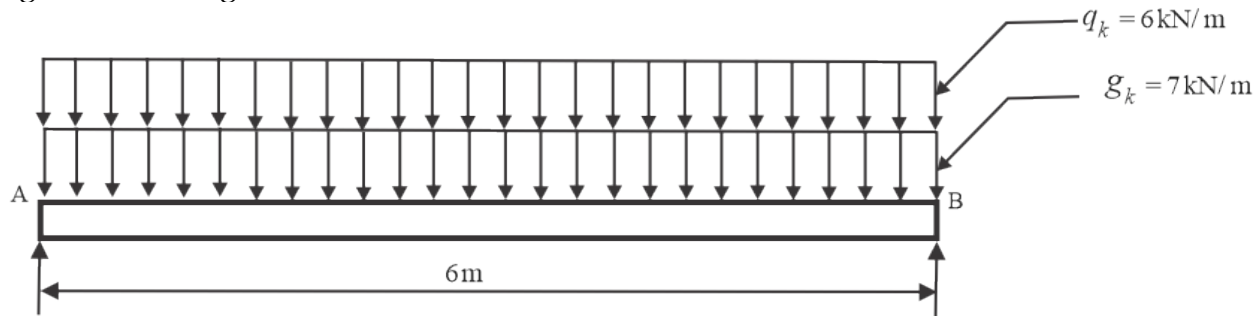


Figure Q2

Question Three (20 marks)

- (a) Explain the **THREE** methods used in structural steel Design. [5 marks]
- (b) A steel cased $305 \times 305 \times 137 \text{ kgm}^{-1} \text{ UC}$ column in grade S275 shown in figure Q3 is to be used in the structural frame of low cost Engineering workshops at Egerton University. Calculate the compressive resistance of the column if it is encased in concrete of compressive strength 25 N/mm^2 . Assume that the effective length of the column about both axes is 4m.

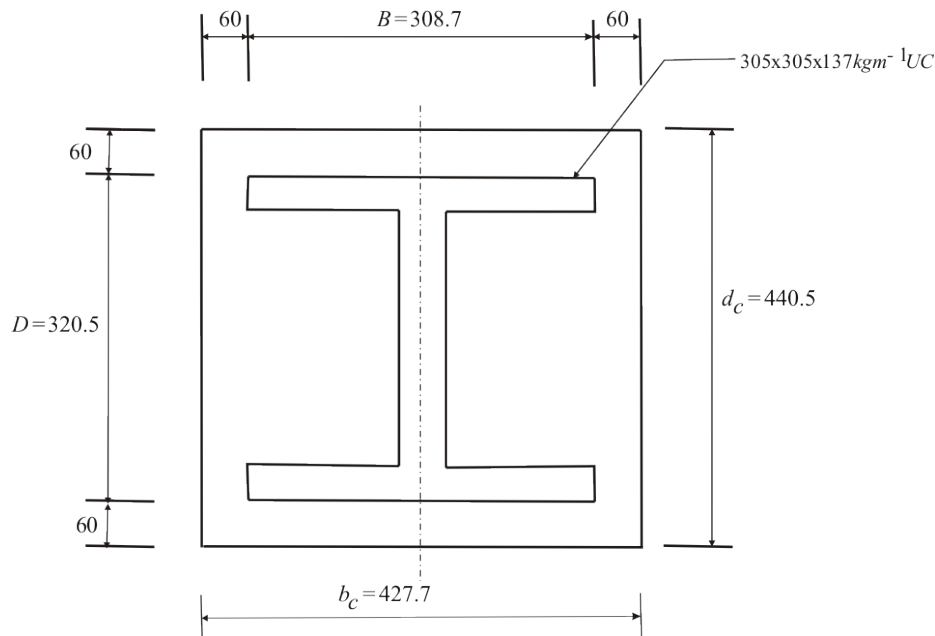


Figure Q3

Question Four (20 marks)

Calculate the design resistance of the connection detail shown in figure Q4. The cover plates are made of S275 steel and connected with either

- a) non-preloaded bolts of diameter 20 mm and class 4.6 or (14 marks)

b) Prestressed bolts of diameter 16 mm and class 8.8 **(6 marks)**

Assume that in both cases, the shear plane passes through the unthreaded portions of the bolts.

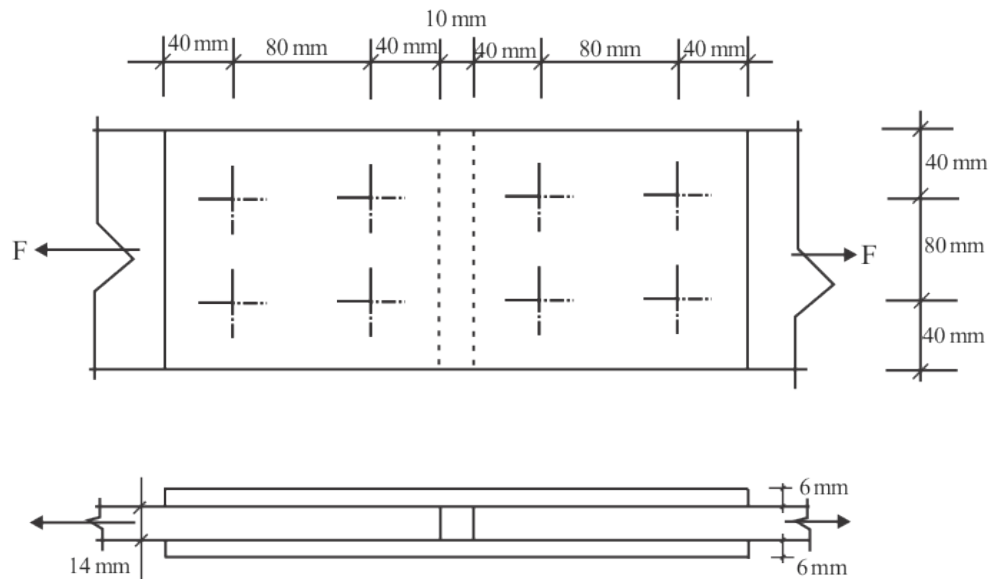


Figure Q4