



MACHAKOS UNIVERSITY

University Examinations for 2024/2025 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 404: STRUCTURAL DESIGN I

DATE: 13TH JANUARY, 2025
PM

TIME: 11.00 AM – 1.00

INSTRUCTIONS:

*Answer question **ONE (Compulsory)** and any other **TWO** questions*

QUESTION ONE (COMPULSORY) (30 MARKS)

- (a) Select a suitable UB section to function as a simply supported beam carrying a 140 mm thick solid concrete slab together with an imposed load of 7.0 kN/m^2 . Beam span is 7.2 m and beams are spaced at 3.6 m intervals. The slab may be assumed capable of providing continuous lateral restraint to the beam's top flange. (18 marks)
- (b) Briefly discuss four ways in which a bolted structural steel connection may fail when in service. (12 Marks)

QUESTION TWO (20 MARKS)

- (a) Discuss three failure modes of steel beams when used in construction. (9 Marks)
- (b) Design a simply supported beam carrying a concrete floor slab over a span of 5.0 m in grade S275 steel. The un-factored dead load, which includes and allowance for self-weight, is 14 kN/m , and the ultimate un-factored imposed load is 19 kN/m . (11 Marks)

QUESTION THREE (20 MARKS)

Check the stability of a $203 \times 203 \times 52 \text{ UC}$ in S275 steel to withstand an axial compressive load of 1250 kN over an unsupported height of 3.6 m assuming that both ends are held in position but are provided with no restraint in direction.

QUESTION FOUR (20 MARKS)

- (a) List five advantages that structural steel has over other construction materials when used in construction of structures. (5 Marks)
- (b) Design a single unequal angle tie in steel grade S355 for the member AB shown in Fig. Q4(b). The member carries a dead load and imposed load of 122kN and 220kN respectively. Design for both welded and bolted connections. (15 Marks)

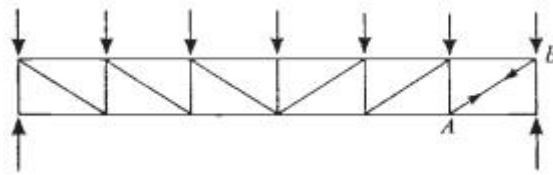


Fig. Q4(b)

QUESTION FIVE (20 MARKS)

Design a suitable base plate for a 203 x 203 x 60 UC S275 column section considering that it is carrying an axial load of 1900kN.