



MACHAKOS UNIVERSITY

University examinations 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FOURTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR
BACHELOR IN CIVIL ENGINEERING

ECV 404: STRUCTURAL DESIGN I

Date 7/3/2023

Time: 8:30 – 10:00 AM

INSTRUCTIONS

1. This paper comprises five questions. Answer three questions
2. Question one is **compulsory** and carry 30 marks
3. Answer any other **two** questions

INSTRUCTIONS

- i. Answer question one and any other two questions
- ii. All symbols have their usual meaning
- iii. Only relevant design codes are allowed

QUESTION ONE (30 Marks)

- (a) A 7.0m long 152 x 152 x 30 UC in grade S275 steel is to be used as a strut with pinned ends and will carry axial load only. Determine its compression resistance. (20 marks)
- (b) Briefly discuss four ways in which a bolted structural steel connection may fail when in service. (10 Marks)

QUESTION TWO (20 Marks)

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. (20 Marks)

QUESTION THREE (20 Marks)

Check the stability of a 203 x 203 x 52UC 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. (20 Marks)

QUESTION FOUR (20 Marks)

- List five advantages that structural steel has over other construction materials when used in construction of structures. (5 Marks)
- Design a single angle to carry a dead load of 80 kN and an imposed load of 35 kN assuming bolted connection and welded connection in steel grade S275. (15 Marks)

QUESTION FIVE (20 Marks)

The joint shown in Figure Q5 is subjected to a tensile dead load of 85 kN and a tensile imposed load of 95 kN. The data regarding the member and joint is given in the figure. The steel is Grade S275 and the bolt Grade 8.8. Check that the joint is satisfactory.

2No 100 x 65 x 8 equal angle sections

Bolts – 20 mm diameter ordinary bolts

Holes – 22 mm diameter

