



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)  
*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

*Institutional Based Program*

## UNIVERSITY EXAMINATION FOR BACHELOR OF TECHNOLOGY IN CIVIL ENGINEERING

EBC 2317: STEEL AND TIMBER DESIGN

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

### Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions in **TWO** sections **I & II**

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

Maximum marks for each part of a question are clearly shown

This paper consists of **TWO** printed pages

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### SECTION I (Compulsory)

#### Question 1

- a) Outline the factors that should be considered in the design of flexural timber members  
(7½ marks)
- b) A flat roof spanning 4.25m effective span is to be designed using SC3 timber joists at 600mm centres. The joists bear on 100mm wide timber wall plates. The loads from the proposed roof construction are as follows:
- |                         |   |                        |
|-------------------------|---|------------------------|
| • Asphalt 20mm thick    | = | 0.45kN/m <sup>2</sup>  |
| • Screed                | = | 0.30kN/m <sup>2</sup>  |
| • Timber firings        | = | 0.01kN/m <sup>2</sup>  |
| • Ceiling               | = | 0.15 kN/m <sup>2</sup> |
| • Self weight of joists | = | 0.10 kN/m <sup>2</sup> |
| • Imposed load          | = | 0.75 kN/m <sup>2</sup> |

Determine a suitable size of SC3 timber joists

(12½ marks)

**SECTION II (Answer any TWO questions)**

**Question 2**

- a) Discuss the factors that should be considered in the design of compression timber members (10 marks)
- b) An SC4 timber post 2.5m in height supports a total long-term load of 40kN applied at 75mm eccentricity to its x-x axis. Check the adequacy of a 100 x 250mm sawn timber section if it is restrained at both ends in position and at one end in direction (10 marks)

**Question 3**

- a) Outline the main modes of failure of steel beams and joists (9 marks)
- b) A 10m long simply supported steel beam supports uniformly distributed characteristic dead and imposed loads of 5kN/m each as well as a characteristic imposed point load of 30kN at its mid span. The beam is fully laterally restrained. Select a suitable universal steel beam section in grade 43 steel to satisfy bending, shear and deflection. Take the modulus of elasticity of steel as 205 kN/mm<sup>2</sup> (11 marks)

**Question 4**

- a) With the aid of sketches, outline the various types of standard rolled universal steel sections stating the situations where each may be used (10 marks)
- b) Select a suitable universal steel column section in grade 43 steel to support ultimate loads of 200kN from beam A and 75kN from beam B. The length of the column is 7m and its self-weight can be taken as 5kN initially. Note that the design of the steel column is to be in simple construction where the column is effectively held in position at both ends but only restrained in direction at the bottom (10 marks)

**Question 5**

- a) With the aid of sketches, illustrate the various types of welds used in structural steelwork connections (4½ marks)
- b) With the aid of sketches, define the following terms as they apply in timber connections. (6½ marks)
- (i) Edge distance
  - (ii) End distance
  - (iii) Fastener spacing
  - (iv) Effective cross-section
- c) A nailed timber-to-timber joist is required to transmit a medium-term axial load of 2.475kN. The timber is a softwood of strength class SC5 and size 50mm wide and 150mm deep. Determine the number of nails required and their spacing if 4mm diameter and 90mm long wire nails are to be used. Take the following modification factors as shown here below:
- K48 = 1.12
  - K49 = 1.00

• K50 = 1.00

(9 marks)