



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

**ECE 2407: STRUCTURAL DESIGN I**

SPECIAL/SUPPLEMENTARY EXAMINATION

**SERIES: SEPTEMBER 2018**

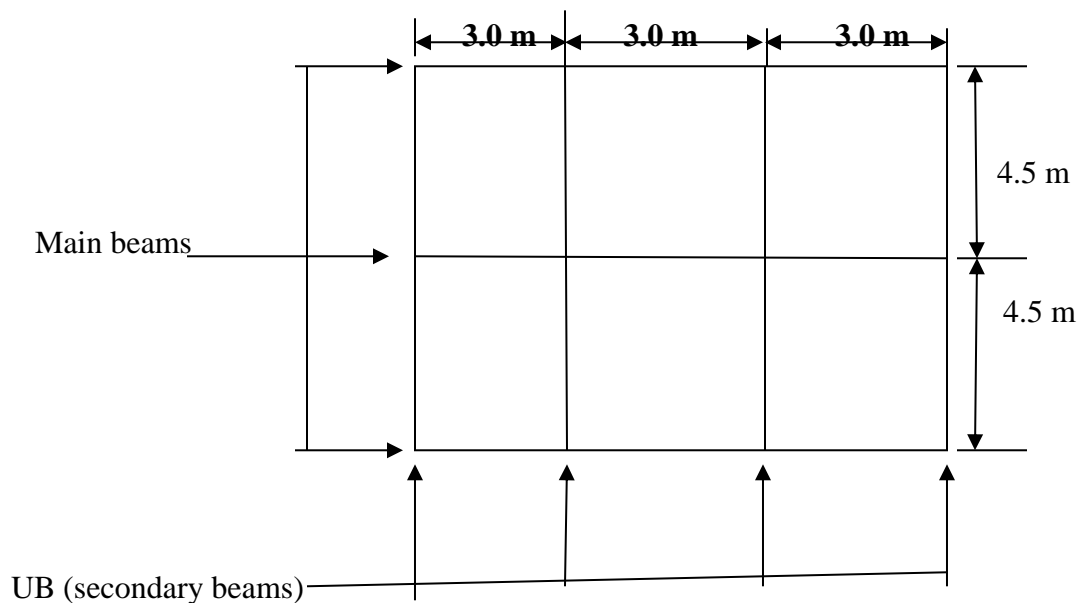
**TIME: HOURS**

**Instructions to the candidate:**

1. You should have the following for this examination:
  - **Answer booklet.**
  - **Mathematical Table/Pocket Calculator.**
2. This paper consists of **FOUR** questions.
3. Answer question **ONE (Compulsory)** and any other **TWO** questions.

**Do not write on the question paper**

**Question ONE (Compulsory) 30 Marks**



**Figure 1.1: Steel floor frame**

**Figure 1.1** shows a proposed concrete floor supported on grade 43 secondary steel beams, transferring load to main beams of the same material.

**Data:** Steel working stress  $f_s = 165 \text{ N/mm}^2$ , Floor design load =  $8 \text{ kN/m}^2$ , Self weight of the main beam =  $15 \text{ kN}$  (estimated), maximum deflection allowed =  $(1/360)$  of the span, for steel E =  $210 \text{ kN/mm}^2$ .

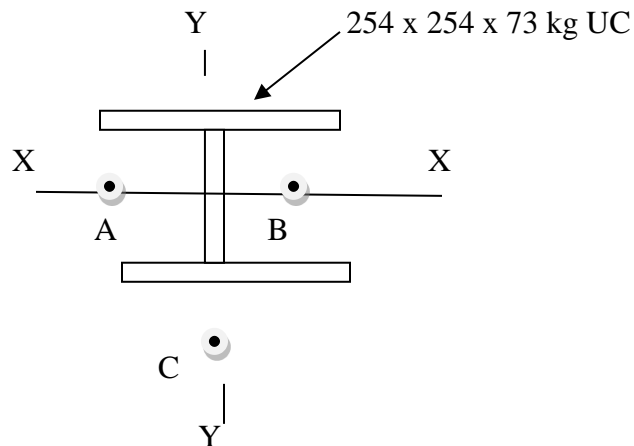
- (a) Make the necessary calculations and select, from the steel tables provided, suitable sections for
- (i) Secondary beams,
  - (ii) Centre main beam.
- (b) Check the main beam against the serviceability limit state of deflection.

**(30 marks)**

**ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

**Question TWO (20 Marks)**

An intermediate length of a stanchion is  $4.8 \text{ m}$  long and is loaded as shown in Figure 2.1.



**Figure 2.1:** Intermediate steel stanchion

Loading on the column:

- (i) A = web load =  $100 \text{ kN}$
- (ii) B = web load =  $150 \text{ kN}$
- (iii) C = flange load =  $100 \text{ kN}$
- (iv) Axial load transmitted from the length above =  $650 \text{ kN}$

The loads indicated are transmitted by floor beams and by the stanchion length above, which is 4.5 m long and consists of a 203 x 203 x 71 kg UC. Test the suitability of the section, with grade 43 steel.

**(20 marks)**

**Question THREE (20 Marks)**

Design a suitable a gusseted base for 254 x 254 x 73 kg universal column which transmits an axial load of 1100 kN. The base plate is to rest on 1:2: 4 concrete (safe bearing pressure 4200 kN/m<sup>2</sup>).

**(20 marks)**

**Question FOUR (20 Marks)**

A timber beam with a clear span of 2.85 m supports a uniformly distributed load of 10 kN including the self- weight of beam. Determine a suitable section for the beam using timber of strength class SC3. Assume that the bearing length is 150 mm and that the ends of the beam are held in position and the compression edge is held in line. Permissible deflection ( $\delta$ ) = 0.003(*centre to centre span*).

**(20 marks)**