



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

INSTITUTIONAL BASED PROGRAMME

DIPLOMA IN CIVIL ENGINEERING WITH COMPUTER AIDED DESIGN  
DIPLOMA IN BUILDING & CIVIL ENGINEERING

**EBC 2302: THEORY OF STRUCTURES I**

END OF SEMESTER EXAMINATION

**SERIES: DECEMBER 2011**

**TIME: 2 HOURS**

**Instructions to Candidates:**

This paper consists of **FIVE** questions

- *Answer Booklet*
- *Scientific Calculator*
- *A set of drawing instruments*

Answer question **ONE (COMPULSORY)** in **SECTION A** and any other **TWO** questions in **SECTION B**

Marks are indicated for each part of the question

This paper consists of **THREE** printed pages

**SECTION A (Answer all questions in this section - 30 Marks)**

**Question One**

- a) A universal column section acting as a stanchion carries an axial load and two further loads from incoming beams supported on brackets. The arrangement of loads may be assumed to be as that shown in figure 1. Determine the extreme fibre stresses action at the corners A, B, C and D. Properties of the universal column section:  $A = 11,400\text{MM}^2$ .

$$I_{xx} = 143 \times 10^6\text{mm}^4, I_{yy} = 48 \times 10^6\text{mm}^4 \quad (20 \text{ marks})$$

Figure 1

- b) A rectangular strut is 150mm wide and 120mm thick it carries a load 180KN at an eccentricity of 10mm in the plane by bisecting the thickness. Determine:
- (i) Maximum stress intensity
  - (ii) Minimum stress intensity
- (10 marks)

**SECTION A (Answer all questions in this section - 20 Marks each)**

**Question Two**

A horizontal beam of uniform section and 6m long is simply supported at its ends. Two vertical concentrated loads of 48KN and 40KN at 1m and 3m respectively from the left hand support. Determine the position and magnitude of the maximum deflection if  $E = 200\text{GN/m}^2$  and  $I = 85 \times 10^{-6}$

(20 marks)

Figure 2

**Question Three**

A hollow alloy tube 5m long with diameter 40mm and 25mm respectively was found to extend 64mm under a tensile load 600KN.

- a) Calculate the bulking load for the tuber when used as a strut with both ends pinned.

- b) Determine the safe load on the tube (12 marks)  
(8 marks)  
*(Take factor of safety 4)*

#### Question Four

A column 3m long hinged at its both ends is made up of two channels ISJC 200 and 225cm x 1cm flange plates as shown in figure 3.

Figure 3

Determine the maximum eccentricity for a load 40 tonnes from y-y axes, if the maximum permissible stress is  $800\text{kg/cm}^2$ . Take  $E = 2 \times 10^6 \text{ kg/cm}^2$ . The properties of channel section are  $A = 17.7\text{cm}^2$ ,  $I_{yy} = 84.2\text{cm}^4$ , distance of centroid from back of web = 1.97cm (20 marks)

#### Question Five

- a) State Mohr's theorems for slope and deflection (2 marks)  
b) Figure 4 shows a loaded cantilever beam. Using Mohr's theorems, determine the deflection at point B, C and the slope at C in terms of  $EI$  (18 marks)

Figure 4

