



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING (DC 011)

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBC 011)

ECV 2201: THEORY OF STRUCTURES I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MAY/JUNE 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Calculator*

This paper consists of **FIVE** questions

Answer question any **THREE** questions

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

Question 1 (20 marks)

- 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 acting at the corners A, B, C and D. Properties of the universal column section: $A = 11,400\text{mm}^2$.

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

90KN

- 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. Find the maximum and minimum intensity of stress in the section. (10 marks)

Question 2 (20 marks)

A horizontal beam of uniform section and 6m long is simply supported at its ends. Two vertical concentrated loads of 48KN and 40KN act 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 $I = 85 \times 10^6 \text{m}^4$ (20 marks)

Figure 2

Question 3 (20 marks)

A hollow allow tube 5m long with diameter 40mm and 25mm respectively was found to extend 6.4mm under a tensile load 600KN. Calculate the bulking load for the tube when used as a strut with both ends pinned. Also find the safe load on the tube, taking factor of safety as 4. (20 marks)

Question 4 (20 marks)

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.

Y

Determine the maximum eccentricity for a load 40 tonnes from y – y axes, if the maximum permissible stress is 800kg/cm^2 . Take $E = 2 \times 10^6 \text{ kg/cm}^2$. The properties of channel section are: $A = 17.77\text{cm}^2$, $I_{yy} = 84.2\text{cm}^4$. Distance of the centroid from back of web = 1.97cm. (20 marks)

Question 5 (20 marks)

- a) State Mohr's theorems for slope and deflection
- b) Figure 4 shows a loaded cantilever beam. Using Mohr's theorems, determine the deflection at points B. C and the slope C in terms of EI (20 marks)

Figure 4