THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

CONSTRUCTION TECHNICIAN II (CTII 12J)

EBC 1104: COLUMNS, STRUTS & COMBINED FORCES

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
- *Calculator*

This paper consists of **FIVE** questions
Answer 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) State the assumptions in Eulers Column Theory

b) A hollow column of 200mm external diameter and 160mm internal diameter is used as a column of 4.5m length. Calculate the Rankine's crippling load when the column is fixed at both ends. Take allowable stress as 350N/mm^2 and Rankine's constant as 1/1600

Question 2 (20 marks)

a) With the aid of sketch, explain the **FOUR** types of end connections condition of column

b) A hollow alloy tube 4m long with external and internal diameters of 40mm and 25mm respectively was found to extend 4.8mm under a tensile load of 60KN.
    (i)   Find the buckling load for the tube with both ends pinned
    (ii)   Find the safe load o the tube, taking a factor safety as 5

Question 3 (20 marks)

A T-section in figure 1 150mm x 120mm x 20mm is used as a strut of 4m long; hinged at its ends. Calculate the crippling load. Take Young's Modulus for material to be 200KN/mm^2

        120mm

Question 4 (20 marks)

a) A rectangular column of size 300 x 200mm carries a load of 300KN at an eccentricity of 15mm is a plane bisecting the thickness as shown in figure

Determine the maximum and minimum intensities of stress in the section

Figure 2

b) An I in figure 3 is section 400 x 200 x 20 mm and 6 m long is used as a strut with both ends fixed.
Calculate Euler's crippling load for the column.
Take $E = 205KN/mm^2$

Figure 3

Question 5 (20 marks)

A masonry pile of 3 x 4m supports a vertical load of 80KN as shown in figure

Determine:-
a) The stress developed at each corner of the pile
b) Additional load placed at the centre of the pile so that there is no tension on the pile
c) The stresses at the corners with the additional load at the centre

0.5m