THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

CONSTRUCTION TECHNICIAN II (CT II 011)

EBC 1104: COLUMNS, STRUTS & COMBINED FORCES

END OF SEMESTER EXAMINATION

SERIES: AUGUST/SEPTEMBER 2011

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: **A** and **B**
Answer question **ONE** is compulsory from Section A and any other **TWO** questions from section B
Maximum marks for each question are as shown
This paper consists of **FOUR** printed pages

SECTION A – COMPULSORY

Question 1

a) Explain the following:

(i) Long column
(ii) Short column
(iii) Slenderness ratio (5 marks)

b) State the assumptions of Euler's column theory (9 marks)

c) Using sketches, explain **FOUR** Euler's end fixing of columns (16 marks)

SECTION B *(Answer any TWO questions)*

Question 2

$$P = F_C A / \left[+ \frac{fc}{\pi^2 E} \left(L \diagup K \right)^2 \right]$$

a) Show that Rankine – Gordon formula for struts (10 marks)

b) A cast iron hollow column haming 8cm external and 6cm internal ϕ is used as a column of 2m long. Using Rankine formula, determine the crippling load when ends are fixed.
Take f_c = 600Kg/cm^2, a = 1/1600 (10 marks)

Question 3

a) A rectangular column size 300 x 200 mm thick carries a load of 300KN at an eccentricity of 15mm in the plane bisecting the thickness as shown in figure 1

Find the maximum and minimum intensities of stress in the section (10 marks)

Fig 1.0

d = 200

b) A tee section shown in figure 2 is 150 x 120 x 20 is used as a strut – 4(m) hinged at its both ends. Calculate the crippling load if E = 210KN. (10 marks)

Fig 2.0

120 mm

Question 4

A rectangular beam has a prestress of 270 KN at point A as shown in figure 3.

a) Calculate the stress at the top and bottom surface of the beam due to the thrust only
b) Determine additional sagging moment to be sustained if no tension is allowed to occur at the bottom surface of the beam
c) The compressive stress at the top surface under the combined effect of thrust and moment in (b) (20 marks)

Fig 3.0

50 mm

Question 5

A masonry pile of (3 x 4m) supports a vertical load of 30 KN as shown in Fig 4.0

a) Find the stress developed at each corner of the pile
b) What additional load should be placed at the centre of the pile so that there is no tensional anywhere on the pile
c) What are the stresses at the corners with the additional load at the centre (20 marks)

Fig 4.0

X