THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING

ECE 2215: THEORY OF STRUCTURES II

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: FEBRUARY 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Scientific Calculator (Non-programmable)*
- *Relevant Graph papers, Charts/Tables (provided)*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

Question One (Compulsory)

a) A rectangular hollow column section with both ends fixed has cross-sectional dimensions of 200 x 150 (d x b) and 20mm thick is 3.0m long. Compare its crippling loads by Euler and Rankine's formula given that:
Fc = 60KN/cm^2
E = 2000KN/cm^2

$$\frac{1}{P} = \frac{1}{PC} + \frac{1}{PE}$$

From the values obtained, show that: . **(15 marks)**

b) Describe the 'NO TENSION' analogy and briefly explain its relevance in Civil Engineering.

(4 marks)

c) (i) A cast iron bracket subjected to bending has a cross-section of I-shape with unequal flanges as shown in figure B1. If the compressive stress in top flange is not to exceed 17.5N/mm^2, what is the bending moment the section can take?

(ii) If the section is subjected to a shear force of 100KN, find the shear stresses at the junctions.

(11 marks)

Figure B1

Question Two

A short cast iron, rectangular column 16cm x 20cm sectional dimension has a circular bore of 8cm diameter as shown in figure B2, carries an eccentric load of 10,000kg located as shown in the figure. Determine the values of the stresses at the four corners of the section.

Figure B2

Question Three

a) From the first principles show that the Eulers critical load with one end fixed and other ends free is given by:

$$P = \frac{\pi^2 EI}{4L^2}$$

(17 marks)

b) List THREE assumptions of Rankine's theory for active pressure

Question Four

a) The composite beam shown in figure B3 below is subjected to a bending moment of 650KN-m. Given that, the Youngs Modulus for steel is 480KN/m^2 and that of timber is 24KN/m^2, determine the maximum stress in steel and timber. **(12 marks)**

Timber

b) A hollow alloyed tube 5m long with 40mm diameter and 25mm diameter external and internal diameters respectively, was found to extend 6.4mm under a tensile load of 60KN. Determine the Euler's buckling load for the tube when used as a strut with both ends fixed. **(8 marks)**

Question Five

a) The figure below shows a masonry retaining wall. The retained material consists of two soils with the upper soil having a unit weight of 20KN/m^3 with ϕ of 30^o while the bottom soil having weight of 24KN/m^3 and ϕ of 30^o if the surcharge material is 18KN/m^2 find the resultant lateral pressure and distance of point of application from the bottom. **(16 marks)**

Figure B4

b) With the use of well labeled sketches, draw the **FOUR** end fixing conditions of columns giving the value of their effective lengths with respect to the original length and hence give the Euler's formula crippling load for each. **(4 marks)**

Figure 4