TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2214: STRENGTH OF MATERIALS II

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions.
Answer question **ONE** 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

a) A rectangular section column with 200mm x 150mm (db) 20mm thick and 2.0m long is used as a strut with both ends pinned. Compare its crippling load by Eulers and Rankines formula hence show that:

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

Given that the crushing strength of the column material is 60KN/mm^2 and Es = 200KN/mm^2
(15 marks)

b) Explain the 'NO' tension analogy in column and briefly describe its relevance in Civil Engineering.
(4 marks)

c) A cast Iron bracket subjected to bending has a cross-section of 1 shape with unequal flanges as shown on figure 1C.

(i) If the compressive stress in top flange is not exceed 17.5N/mm^2, what is the bending moment the section can take.

(ii) If the section is subjected to shear force of 100KN, draw the shear stress distribution over the depth of the section

Figure 1 c

(11 marks)

Question Two

A hollow rectangular section column 160mm x 200mm (bd) with a circular hole of 80mm diameter as shown in figure 2. It carries an eccentric loading of 10 tonnes located at point P as shown. Determine the values of stresses at the corners of the section.

Figure 2

(20 marks)

Question Three

a) From the principles of buckling of compression members; show that, the buckling load of column with one end fixed and other end free is given by:

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

(17 marks)

b) Outline **THREE** assumptions of Rankine theory for active pressure. **(3 marks)**

Question Four

a) The composite beam shown in figure 4a is subjected to a bending moment of 650KNm. Determine the maximum stresses in steel and in timber given that, the ratio of Yong's Modulus of steel and that for timber is 20:1

Timber

(12 marks)

b) A hollow alloyed tube 5m long with diameters 40mm and 25mm external and internal respectively was found to extend 6.4mm under a tensile load of 60KN. Find the buckling load by Euler's formula with both ends fixed. **(8 marks)**

Question Five

Figure 5a shows a retaining wall supporting soils 1 at the top and soil type 2 at the bottom and a surcharge of 18KN/m^3. Given that:

- Weight of upper soil W1 = 20KN/m^3
  $\phi = 30^o$
- Weight of bottom soil W2 = 24KN/m^3
  $\phi = 30^o$

Find the resultant lateral pressure and distance of point of application from the bottom.

3m

Fig. 5a

(20 marks)