TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DECREE IN:

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE)

ECE 2214: STRENGTH OF MATERIALS II

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2014
TIME ALLOWED: 2 HOURS

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

This paper consists of **FIVE** questions. Answer any **THREE** questions
Maximum marks for each part of a question are as shown
Use neat, large and well labeled diagrams where required
This paper consists of **THREE** printed pages

Question One

a) Define The following terms:
   (i) A column
   (ii) A strut
   (iii) Stress
   (iv) Strain
   (v) Slenderness Ratio **(10 marks)**

b) Briefly elaborate three states of stability of a strut. **(6 marks)**

c) State Rankine's St Venant's and Tresca's theories of brittle materials **(6 marks)**

d) Derive:
   Total Moment of Resistance (MR) equation:

$$M = \left(MI_S + I_t\right)\frac{Ft}{y}$$

(10 marks)

e) State Euler's Column theory assumption **(8 marks)**

Question Two

a) Explain the Euler critical load for a column hinged at both ends. **(10 marks)**

Figure 1

b) A flitched timber beam made up of steel and timber ahs a section as shown below. Determine the MR of the beam. Assume: **(10 marks)**

$f_s = 10KN/cm^2$

$f_t = 0.5KN/cm^2$

Figure 2

Question Three

a) A bending moment of 6KNm is applied about x-x axis of a composite beam of the section dimensions shown below. Determine the maximum bending stresses induced in it if the elastic modulii are:

$Et = 10.5KN/mm^2$

$Es = 210KN/mm^2$

Figure Q3 (a)

b) Using an illustration, describe:
- **(i)** Compression force
- **(ii)** Tensional force **(8 marks)**

Question Four

a) A solid steel shaft is to transmit a torque of 100KNm. If the stearing stress is not to exceed 4.5 KN/cm^2. Find the maximum diameter of the shaft. **(4 marks)**

b) State THREE assumptions for determination for torsion stress in a circular shaft and hence define torque. **(4 marks)**

c) Determine the distribution of pressure at the base of wall in the above retaining wall. Given that densities of retained soil and retaining wall are $18KN/m^3$ and $24KN/m^3$ respectively. Assume angle of repose to be 30^o **(12 marks)**

Figure Q4(c)

Question Five

a) Differentiate between active earth pressure and passive earth pressure. **(4 marks)**

b) State the conditions for the stability of a retaining wall hence give a definition of a retaining wall **(6 marks)**

c) Determine the corners stresses induced in a masonry pier loaded as shown below.

3.0m

Hence find centroid additional load required to ensure no tensile stresses exists in section

(10 marks)