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 DEGREE IN BACHELOR OF ENGINEERING IN BUILDING & CIVIL ENGINEERING
(Institutional Based Programme)

EBC 4222: STRENGTH OF MATERIALS II

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2012
TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination
- *Answer Booklet*
- *Scientific Calculator/Mathematical Tables*

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 **THREE** printed pages

SECTION A (COMPULSORY)

Question One (30 marks)

a) A hollow circular shaft is designed to transmit 130KW at 1.65Hz. The inside diameter of the shaft is to be one half of the outside diameter. If allowable shear stress is to be 45Mpa, calculate the required minimum shear stress outside diameter. **(15 marks)**

b) Figure 1 shows a section of a strat 3.0m long.

Figure 1

Determine the Evier buckling load for the following cases:

i) Both ends of the struts pinned
ii) One end fixed and the one pinned
iii) Both ends of the strut fixed
Take $E = 210GN/m^2$ **(15 marks)**

SECTION B (ATTEMPT ANY TWO QUESTIONS FROM THIS SECTION)

Question Two (20 marks)

A beam has its cross-section shown in figure 2.

Figure 2

The beam is subjected to an axial load of 170KN and a sugging moment of 25KNm. Determine:

i) Maximum compressive stress **(10 marks)**
ii) Tensile stress **(10 marks)**

Assume both compressive and tensile for the axial load

Question Three (20 marks)

a) A hollow circular to be 0.55m long has an inside and outside diameters of 30mm and 40mm respectively. The tube is subjected to twisting by torque T applied at both ends. Calculate the shear modulus of elasticity for the material.

Take: Angle of rotation $\phi = 0.005$
radius
Torque T = 640Nm **(8 marks)**

b) A wooden beam of dimensions b = 200m and h = 300mm is reinforced on its sides by steel plates 12mm thick. Calculate the allowable bending moment about the axis of the beam.

Take: Modulus of elasticity for steel = 2004 Gpa
Modulus of elasticity for wood = 8.5Gpa
Allowable stress for steel = 130Mpa
Allowable stress for wood = 8.5Mpa **(12 marks)**

Question Four (20 marks)

a) A simply supported wooden composite beam is loaded with a single concentrated load P at mid span. The beam has a span of 4m. The beam sections (b = 150mm and h=250mm) is reinforced with a steel plate 10mm thick. Determine the minimum load P if the allowable stresses in wood and steel are 70Mpa and 100Mpa respectively.

Take: Young's Modulus for wood = 210Gpa
Young's Modulus for steel = 10 Gpa **(20 marks)**

Question Five (20 marks)

Figure 3 shows a cross-section of a retaining wall:

Figure 3

Determine lateral earth pressure distribution for the wall.
Take: γ_w for the wall material = 24KN/m^3

$_s$ for the soil = 18KN/m^3

$\phi = 35^o$

Angle of internal friction

$\beta = 25^o$

Retained soil slopes at to the horizontal **(20 marks)**