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 CIVIL ENGINEERING

ECE 2214: STRENGTH OF MATERIALS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Non-Programmable Scientific Calculator*

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 simple supported beam of 10m span carries a load of 10KN at a distance 6m from the left end. Using double integration method of slope and deflection, determine:

(i) Slope at the left load (4 marks)

(ii) Deflection under the load (4 marks)

(iii) Maximum deflection of the beam. (4 marks)

b) A single point load of 80KN crosses a girder of 12m span. Using influence line, find the maximum positive and negative shear force and bending moment at a point 4m from the right end. (8 marks)

c) From first principles of slopes and deflection, by method of double integration, show that the maximum deflection of a simply supported beam loaded at the centre of a simply supported beam

$$y = \frac{WL^3}{48EI}$$

loaded at the centre with a point load is given by:

(8 ½ marks)

d) List **THREE** rules observed when analyzing a beam by Macauleys Method. (1 ½ marks)

Question Two

a) Figure Q2 below shows a continuous beam loaded as shown and supported at point A, B and C. Using 3-moment method, determine:

(i) Moment at support and mid spans
(ii) Reactions at supports
(iii) Draw the bending moment, indicating the negative and positive points of the beam.

(17 marks)

b) Define the term "influence line" and briefly describe the TWO uses in engineering. (3 marks)

Question Three

a) From the first principles, show that the Euler's critical load with both ends hinged is given by:

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

(15 marks)

b) List the **THREE** assumptions of Rankine's theory for active pressure. **(3 marks)**

c) In normal Engineering practice we are always advised to take into account of bending in the design of struts. As an Engineer, list **THREE** conditions which call for this. **(2 marks)**

Question Four

a) A composite beam shown below is subjected to a bending moment of 50KNm. Determine the maximum stresses in steel and timber given that the ratio of Young's Modulus for steel and that of timber is 12:1 **(8 marks)**

b) Differentiate between Active and Passive pressures as used in retaining walls. **(3 marks)**

c) List **FOUR** assumptions of Euler's column theory. **(2 marks)**

d) An I-section joist size 400 x 200 x 20mm thick and 6m long is used as a strut compare Euler's buckling load for the column if E = 210KN/mm^2, when

(i) Both ends fixed
(ii) One end fixed and other hinged **(7 marks)**

Figure 2

Question Five

a) Figure below shows a Masonry retaining wall of trapezoidal section with a vertical force on the earth side, 1m wide at the top, 3m wide at the bottom and 6m high. It retains sand over the entire height with an angle of surcharge of 20o. Determine the distribution pressure at the base of the wall given that:

- Density of sand = 18KN/m^3
- Angle of repose of sand = 30^o
- Unit weight of Masonry = 24KN/m^3

1m

Determine:

(i) Total pressure per meter of the wall **(3 marks)**
(ii) Horizontal and vertical components of pressure **(3 marks)**
(iii) Total weight acting vertically on the wall **(1½ marks)**
(iv) Position of the C.O.G of vertical load **(3 marks)**
(v) Horizontal distance between C.O.G of wall and point where resultant cuts the base. **(2½ marks)**

b) A Masonry pier 3.0m x 4.0m dimension supports a vertical load of 80KN as shown in figure below.
(i) Find the stresses developed at each corner of the pier. **(5 marks)**
(ii) What additional load should be placed at the centre of pier so that there is no tension anywhere in the pier section? **(2 marks)**

Figure 4