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 2215: THEORY OF STRUCTURES II

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Mathematical Table/Pocket 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 **THREE** printed pages

Question One (Compulsory)

a) Derive an expression for horizontal thrust in a cable. **(8 marks)**

b) Derive an expression for the slope *i* from the bending moment, showing the curvature of the beam. **(8 marks)**

c) A simply supported beam has a span of 20 metres. A uniformly distributed load of 20KN/m and 5 metres long crosses the span. Find the maximum bending moment produced at a point 8 metres from the left support. **(6 marks)**

d) A cantilever beam of length 3m is carrying a uniformly distributed load of WKN/m. Assuming rectangular cross-section with depth (d) equal to twice the width (b), determine the dimensions of the beam, so that vertical deflection at the free end does not exceed 8mm. Take maximum bending stress = 100mpa and E = 200Gpa. **(8 marks)**

Question Two

a) A part truss consists of 6 panels, each 5m, its height being 6.66m as shown in the figure below:

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It is simply supported over a span of 30m and is loaded over the bottom chord.

(i) Draw the influence lines for the forces in member serialed 1, 2 and 3 in the third panel from the left, giving principle values.

(ii) Calculate the maximum values of forces in member 1, 2 and 3. When a uniformly distributed load of intensity 60KN/m longer than the span crosses the structure. **(20 marks)**

Question Three

a) A wooden beam 140mm wide and 240mm deep has a span of 4m. Determine the load that can be placed at its centre to cause the beam a deflection of 10mm. Take E as 6Gpa. **(10 marks)**

b) For a simply supported beam, show that maximum deflection is given by:

$$yc = \frac{WL3}{48EI}$$

(10 marks)

Question Four

a) The equation of a three-hinged arch, with origin at its left support is $y = x - \frac{x^2}{40}$. The span of the arch is 40m.

Find the normal thrust and radial shear force at a section x, 5m for the left support, when the arch is carrying a uniformly distributed load of 30KN/m for the left half. **(15 marks)**

b) A three-hinged parabolic arch has a span of 25m and central rise 4.5m. Determine the maximum positive and negative bending moment at a section 8m from the left hand support, if a uniformly distributed load of 50KN/m rolls over the arch. Also determine the absolute maximum bending moment. **(5 marks)**

Question Five

a) A parabolic arch has a span of 15m and is supported at different level, such that the crown C is 9 metres from the left support A and 6 metres from the right support B.
The right support is higher than left support by 2 metres and the crown is higher by 1.5 metres with respect to right support. The arch is hinged at the two supports and at the crown. Find the maximum bending moment in the arch at a section q lying 4.5 metres from left support, when a point load W rolls over the span. **(20 marks)**