THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2215: THEORY OF STRUCTURES II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011
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)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1 (20 marks)

a) A uniformly distributed load of 50KN/m, longer than span, rolls over a beam of 25m span as shown in figure 1(a) below. Using influence lines determine the maximum shear force and bending moment at a section 10m from the left end support. (6 marks)

b) A three-hinged parabolic arch of span 40m and rise 10m is carrying a uniformly distributed load as shown in figure 1 (b).

(i) Show that for the three hinged parabolic arch, the horizontal thrust is given by:

$$H = \frac{\mu c}{yc}$$

(ii) Find the horizontal thrust at the springing (8 marks)

Figure 1 (b)

c) For a simply supported beam with a central point load, show that the maximum deflection is given by $y_c = \frac{Wt^3}{48EI}$..... using the double integration method (8 marks)

d) A simply supported beam of span 3m is subjected to a central load of 10kN. Find the maximum slope and deflection of the beam. Take $I = 12 \times 10^6 mm^4$ and E = 200 Gpa. (4 marks)

e) A three-hinged parabolic arch has a span of 20m and a central rise of 5m. A point load of 100kN rolls over the arch from left to right. Find the absolute maximum bending moment that will occur in the arch (4 marks)

SECTION B (Answer any TWO questions from this section)

Question 2 (20 marks)

A uniformly distributed load of 50kN/m of 6m length crosses a girder of span 40m from left to right. With the help of influence lines, determine the values of shear force and bending moment at a point 12m from the left support, when the head of the load is 16m from the left support. (20 marks)

Question 3 (20 marks)

a) A three-hinged parabolic arch of span 20 metres and central rise of 5metres carries a point of load of 200kN at 6m from the left hand support as shown in figure 3. Find the reaction at the supports A and B and draw the bending moment diagram for the arch, indicating the position of maximum bending moment (10 marks)

b) A cantilever beam 100 mm wide and 180 mm deep is projecting 2m from a wall. Calculate the uniformly distributed load, which the beam should carry, if the deflection of the free end should not exceed 3.5 mm. Take E as 200 GPa. (10 marks)

Question 4 (20 marks)

A part truss consists of 6 panels, each of 4m, its height being 5.33m as shown in figure 4.

It is simply supported over a span of 24m and is loaded over the bottom chord.

i) Draw the influence lines for force in member serialled 1, 2 and 3 in the third panel. From the left, giving principal values

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

Question 5 (20 marks)

a) A suspension bridge of 40 m span and 3 m wide platform is subjected to a load of $64kN/m^2$. The bridge is supported by a pair of cables having central dip of 4.5m. Find the necessary cross sectional area of the cable, if the maximum permissible stress in the cable material, is not to exceed 1.2×10^5 kN/m^2. (15 marks)

b) A cantilever beam 2 m long is subjected to a uniformly distributed load of 5kN/m over its entire length. Find the slope and deflection of the cantilever beam at its free end. Take (EI) = 2.5 X $10^{12}mm^2$ (5 marks)