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 2317: THEORY OF STRUCTURES IV

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*
- *Battery Powered Programmable Calculators may be used*

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 (30 marks)

a) State the following:

(i)	Castigliano's First Theorem	(2 marks)
(ii)	Castigliano Second Theorem	(2 marks)
(iii)	First Moment of Area Theorem	(2 marks)
(iv)	Second Moment of Area Theorem	(2 marks)
(v)	Principle of Virtual Work	(2 marks)

b) A beam ABC is simply supported at A and B and overhangs from B to C. The span from A to B has a length of 10m, and the overhand has a length of 4m. A concentrated load of 40KN acts at point D, which is 4m from the support at A, and another concentrated load of 10KN acts at C on

the overhand. Using the moment area method, calculate the angles of rotation θ_A and θ_B and the deflection δ_c at the free end C

*Figure 1 (*Take E = 200GPa and I = 1.28 X 10^9 mm^4 (20 marks)

SECTION B (Answer any TWO questions from this section)

Question 2 (20 marks)

Using Castigliano's First Theorem determine the vertical deflection at node 3 (20 marks)

Figure 2 (Take E = 210KN/mm^2 and 5cm^2 for all members)

Question 3 (20 marks)

The beam shown is of constant modulus throughout. It is loaded with a single concentrated load of 10KN at end A of the overhang AB. The beam has an internal pin at C. Using the conjugate beam method

(i) Find the displacement and rotation at point A

(ii) Sketch the deflection diagram and lable the important points (20 marks)

Figure 3 (Take El = 10MNm^2)

Question 4 (20 marks)

Using Castigliano's Second Theorem determine the member forces in the braced frame shown in the figure below taking 2-5 to be the redundant member (20 marks)

Figure 4 (Assume EA is constant for all members)

Question 5 (20 marks)

The single-bay portal frame ABCDE shown below is of constant cross-section throughout, and pinned to rigid foundations at A and D. It is loaded along the beam with 10KN centrally placed and a uniformly distributed load of 15KN/m.

Determine the bending moment at B and C and draw the bending moment diagram (20 marks)

Figure 5