THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

HIGHER DIPLOMA BRIDGING

AMA 2409: CALCULUS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination
- *Answer booklet*
- *Pocket Calculator*
- *Mathematical Table*

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

a) The widths of a boating lake at varying distances from one end are given in the following table:

Distance (m)	0	6	12	20	34	42	52	64	68	76	80
Width (m)	3.0	8.2	12.1	14.2	13.8	13.0	12.5	12.1	9.3	4.2	3.4

Plot a graph of width against distance and calculate the surface area of the lake by Simpson's Rule using 8 intervals. (Take 10mm for 5m as distance scale and 10mm for 1m as width scale)

(16 marks)

b) Find:

(i)
$$\int \frac{x^2 + 3}{x - 4}\, dx$$

(ii)
$$\int (1 + 3x)^3\, dx$$

(iii)
$$\int \tan 2x\ dx$$

(8 marks)

c) Find the area lying above the x-axis and under the parabola $y = 6x - x^2$

(6 marks)

SECTION B (Answer *any TWO questions from this section*)

Question 2

a) Use integration by parts to find:
$$\int \sin x \sin 3x\ dx$$

(9 marks)

b) Use trigonometric substitution to find:

$$\int \frac{dx}{x^2\sqrt{9 - x^2}}$$

(7 marks)

c) Evaluate:
$$\int_{-3}^{-1} \left(\frac{1}{x^2} - \frac{1}{x^3} \right) dx$$

(4 marks)

Question 3

a) For a certain curve $\dfrac{d^2 y}{dx^2} = 2$. Find its equation given that it passes through P(2, 6) with slope 10.

(8 marks)

b) Use partial fraction to find: $\displaystyle\int_3^4 \dfrac{(x+1)\ dx}{x^2(x-1)}$

(12 marks)

Question 4

a) Find the volume of the solid generated by revolving the first quadrant area bounded by the parabola $y = 4 - x^2$ about the y-axis

(6 marks)

b) Find the centroid of the area bounded by $x^2 = 8y$, the x-axis and x = 4

(14 marks)

Question 5

a) Find:

(i) $\displaystyle\int \dfrac{8x^2\ dx}{\left(x^3 + 2\right)^3}$

(ii) $\displaystyle\int \sin^4 x\ dx$

(12 marks)

b) Find the moment of inertia with respect to the y-axis of the plane area between the parabola $y = 9 - x^2$ and the x-axis

(8 marks)