THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN CIVIL ENGINEERING & CAD
DIPLOMA IN ARCHITECTURE
DIPLOMA IN BUILDING & CIVIL ENGINEERING

AMA 2208: CALCULUS III

END OF SEMESTER EXAMINATION

SERIES: AUGUST/SEPTEMBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Mathematical tables/Calculator*

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1

$$f(x) = \frac{\sin x - x}{\tan x - x} \text{ as } x \to 0$$

a) (i) Use L'Hospital's Rule to determine limit of the function , (6 marks)

$$x \to 2,\ f(x) = \frac{x^2 - 4}{x - 2}$$

(ii) Show that as , has a limiting value of 4 (4 marks)

$$f(x) = \frac{1}{3}x^3 + 2x$$

b) (i) Show that , satisfies the hypothesis of the mean value theorem on the interval (0, 3). And find all the values of c, in this interval (6 marks)

(ii) Use Taylor's series to approximate the value of sin 46° correct to six decimal places (14 marks)

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

Question 2

a) Evaluate the following

(i) $\int_0^{\sqrt{(a^2 - x^2)}} \int_0^{e(x+y)} dydx$ (6 marks)

(ii) Use L'Hospital's Rule to determine limit of the function, $f(x) = \frac{\sin 2x}{\sin 5x}$ as $x \to 0$. (5 marks)

b) Evaluate the following:

$$\int_0^{\pi/2} x^4 \sin x \, dx$$

(9 marks)

Question 3

a) If $z(x+y) = (x^2 + y^2)$, show that $\left(\frac{\delta z}{\delta x} - \frac{\delta z}{\delta y}\right)^2 = 4\left(1 - \frac{\delta z}{\delta x} - \frac{\delta z}{\delta y}\right)$ (10 marks)

b) Evaluate $\int y \, ds$, over the area of that part of the circle, $x^2 + y^2 = a^2$, contained in the first quadrant (10 marks)

Question 4

a) Using $f(x) = \sqrt[3]{x}$, approximate the value for $\sqrt[3]{1.1}$, using Taylor's theorem (8 marks)

b) Show that for the function $f = In(x^3 + y^2 + z)$, then $\frac{\delta^3 f}{\delta x \delta y \delta z} = \frac{\delta^3 f}{\delta z \delta x \delta y}$ (12 marks)

Question 5

a) (i) Evaluate: $\int \frac{x^n}{\sqrt{a^2 + x^2}}\, dx$

$$\int \frac{x^3}{\sqrt{(3^2 + x^2)}}\, dx$$

(ii) Use the above solution in Q5 (a) (i), to solve (14 marks)

b) Given $f(x) = \sqrt{(x-1)}$ 0n (2, 5) and $f(x)$ is continuous. Use Mean Value Theorem to prove that a certain point, $\frac{13}{4}$ lies between the boundary (2, 5) (6 marks)