THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR DEGREE IN BACHELOR OF SC./ENG. IN ELECTRICAL & ELECTRONICS/ MECHANICAL & AUTOMOTIVE & BUILDING & CIVIL ENGINEERING

SMA 2172/AMA 4102: CALCULUS I

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

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A** & **B**
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

SECTION A (COMPULSORY)

Question One (30 marks)

a) Define the following terms as used in Algebra:

i) A function **(2 marks)**
ii) Local points **(2 marks)**

$$y = \frac{1}{36 - x^2}$$

b) Calculate the domain and range of function **(4 marks)**

c) Given that $f(x)=3x^2,\ g(x)=\dfrac{1}{\sqrt{1+x}}$ and $h(x)=\dfrac{1+x}{x}$ find the composite function $L=hgf$ **(3 marks)**

d) Find the limit of the function $\dfrac{x^3-125}{x-5}$ as $x\to 5$ **(4 marks)**

e) Find from the first principles, the derivative of the function $f(t)=kt^4$ **(4 marks)**

f) Given that $x=80t$ and $y=64t-16t^2,$ find the value of *t* for which $\dfrac{dy}{dx}=0$ **(4 marks)**

g) Show that the derivative of the function. $y=x\sec^2 3x-\ln\tan x$ is $\sec^2 3x-6x\sin 3x\cos 3x-\cot x+\tan x$

(4 marks)

h) Given that the function $g(x)=5+\dfrac{x}{2}$ find the value of $g^{-1}(x)$ **(3 marks)**

<u>SECTION B (Answer any TWO questions from this section)</u>

Question Two (20 marks)

a) Find $\dfrac{dy}{dx}$ if $x^5+4xy^3-3y^5=2$ **(4 marks)**

b) By using logarithmic differentiation find $\dfrac{dy}{dx}$ if $y^{2/3}=\dfrac{(x^2+1)(3x+4)^{1/2}}{\sqrt{(2x-3)(x^2-4)}}$ **(6 marks)**

c) Calculate the derivative of $y=3\ln\sin x$ **(4 marks)**

d) One side of a rectangle is three times the other. If the perimeter is increased by 2% what is the percentage change in the area? **(6 marks)**

Question Three (20 marks)

a) 1000m of fencing wire is to be used to make a rectangular enclosure. Find the greatest possible area and the corresponding dimensions. **(3 marks)**

b) Find the turning points of the graph $y=2x^3+3x^2-12x+7$ **(4 marks)**

i) Distinguish between maximum and minimum values of the points obtained above **(4 marks)**
ii) Show that the graph passes through (1,0) and find the other point on the x axis. **(2 marks)**

iii) Sketch the above curve. **(2 marks)**

Question Four (20 marks)

a) Find the equations of the normal to the parabola $4y = x^2$ at the points $(-2,1)$ and $(-4,4)$ **(5 marks)**

b) The curve $y = (x-2)(x-3)(x-4)$ cuts the x-axis at the point P (2, 0) Q (3, 0) and R (4, 0). Prove that the tangents at P and R are parallel. **(5 marks)**

c) At what point does the normal to the curve at q cut the y axis? **(5 marks)**

Question Five (20 marks)

a) The side of a cube is increasing at the rate of 6cm/s. Find the rate of increase of the volume when the length of a side is 9cm. **(9 marks)**

b) By applying the concepts of small changes as used in calculus, find the approximate value of $\sqrt{627}$ **(5 marks)**

c) A particle move along a straight line so that aft ts, its distance from O a fixed point on the line is 5m where $s = t^3 - 3t^2 + 2t$. Calculate.

- **i)** The time when the particle is at O **(4 marks)**
- **ii)** The velocity and acceleration at the times calculated in part (i) above. **(3 marks)**
- iii) What is its average velocity during the first second? **(2 marks)**