TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR THE BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

AMA 4103: CALCULUS FOR SCIENCE

END OF SEMESTER EXAMINATION
SERIES: APRIL 2013
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

a) Define the following terms:
(i) A function
(ii) Limit of a function **(4 marks)**

b) Given $g(x) = -x^2 + 4x + 1$. Evaluate:
(i) $g(x+2)$ **(2 marks)**
(ii) $g(t)$ **(1 mark)**

c) Evaluate the following limits:

$$\lim_{x\to -3} \frac{\sqrt{x+7}-2}{x+3}$$

(i) **(4 marks)**

$$\lim_{x\to -2} \frac{x+2}{x^2+x-2}$$

(ii) **(3 marks)**

d) Find the derivative of $y = x^3 + 3$ by first principles. **(4 marks)**

e) Evaluate the following:

$$\int_1^4 \frac{1}{(x+3)^2} dx$$

(i) **(3 marks)**

$$\int 3\sec^2 x \ dx$$

(ii) **(2 marks)**

f) Differentiate the following respect to X:

$$\sqrt{(x^2-1)}$$

(i) **(4 marks)**

$$x^2 + xy^2 + y^3 = 2$$

(ii) **(3 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) Determine the co-ordinates and nature of any turning points of the curve represented by the function $y = x^3 - 7.5x^2 + 18x + 6$

(8 marks)

b) The displacement xcm of slide value of an engine is given by:

$x = 2.2\cos 5\pi t + 3.6\sin 5\pi t$

Evaluate the velocity (in m/s) when t = 30 ms. **(4 marks)**

c) Given $y = 2xe^{-3x}$ show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ **(5 marks)**

d) Evaluate $\frac{d^2y}{d\theta^2}$ when $\theta = 0$ given $y = 4\sec 2\theta$ **(3 marks)**

Question Three

a) Evaluate the following integrals:

(i) $\int \frac{(1+\theta)^2}{\sqrt{\theta}} d\theta$ **(3 marks)**

(ii) $\int x\cos x^2 \, dx$ **(3 marks)**

(iii) $\int_0^{\pi/2} 3\sin 2x \, dx$ **(4 marks)**

b) Determine the area between the curve $y = x^3 - 2x^2 - 8x$ and the x – axis **(6 marks)**

c) If $x = 2t + 3,\ y = t^2 - 1$ find the value of $\frac{dy}{dx}$ at t = 6 **(4 marks)**

Question Four

a) Given $f(x) = \frac{1}{x-3}$ and $g(x) = 2x$. Find each function and state its domain:

(i) $f - g$

(ii) $f \bullet g$ **(4 marks)**

b) Evaluate:

(i) $\lim_{x \to -\infty} \frac{x-1}{x^2 + x - 1}$ **(2 marks)**

(ii) $\lim_{x \to \infty} \left(1 + \frac{1}{n}\right)^{n+5}$ **(2 marks)**

(iii) $\lim_{x \to 0} \frac{3x^2}{\sin^2 x}$ **(2 marks)**

c) Given $f(x) = \frac{x+1}{x+2}$ and $g(x) = \frac{1}{x-3}$ find $fog^{-1}(x)$ **(5 marks)**

d) Define continuity of a function at a point x = x0 **(5 marks)**

Question Five

$3x^2 - 7y^2 + 4xy - 8x = 0$

a) Determine the equation of a tangent to the curve whose equation is at point (-1, 1) **(4 marks)**

$S = 8t - t^2$

b) A particle moves from point A so that after t seconds it is s metres from A where . Find the velocity when (i) t = 0, (ii) t = 4 (iii) t = 5 **(4 marks)**

$\ln\left(2x^3\right)$

c) Find the derivative of **(3 marks)**

$\lim_{x \to 2}\left(\frac{x^2 - 4}{x - 2}\right) = 4$

d) Show that **(5 marks)**

$y = x + \sqrt{x}$

e) Determine the equation of the normal to the curve at (1, 2) **(4 marks)**