TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UPGRADING MATHEMATICS

AMA 1103: CALCULUS

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 2013
TIME ALLOWED: 2 HOURS

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

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions
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

Question One (Compulsory)

a) Find the gradient and the y-intercept of:

$$y = 2 + 3x$$

(i) **(2 marks)**

$$x + y + 1 = 0$$

(ii) (2 marks)

$$2x + 3y = 1$$

(iii) (2 marks)

$$y = 4x$$

(iv) (2 marks)

b) Find the gradient of the curve $y = 2t^4 + 3t^3 - t + 4$ at the points (0, 4) and (1, 8)

c) Determine: $\int \frac{3}{x^2}\, dx$ **(4 marks)**

d) Using first principles find the derivative of $y = \frac{-2}{x}$ **(5 marks)**

e) Differentiate with respect to x **(4 marks)**

$$\left(x^2 + 1\right)^3 \left(x^3 + 1\right)^2$$

f) Integrate $\int \sqrt[4]{x}\ \ dx$ **(3 marks)**

g) Evaluate $\lim_{x \to} \frac{x^2 - 3x + 2}{x^2 - 6x + 8}$ **(5 marks)**

Question Two

a) Using the first principles to differentiate: $y = x^2 - 2x + 3$ **(4 marks)**

b) Differentiate with respect to x **(4 marks)**

$$y = x^2\left(1 + \sqrt{x}\right)$$

c) Differentiate:

$$y = 3x^2 \sin 4x$$

(i) **(3 marks)**

$y = 9\ln 4x$

(ii) **(2 marks)**

$$\lim_{x\to 1} \frac{\sqrt{5x-4}-\sqrt{x}}{x-1}$$

d) Evaluate **(7 marks)**

Question Three

$y = x^2 + 4x + 3$

a) Given the function . Find:

(i) The gradient of the curve **(1 mark)**

(ii) The gradient of the curve at 1, 8) **(1 mark)**

(iii) The equation of the tangent of (1, 8) **(3 marks)**

(iv) The equation of the line perpendicular at the point (1, 8) **(3 marks)**

$$\int_1^3 \left(\frac{x^3 + 5x^2 + 6x}{x+2} \right) 6x$$

b) Integrate: **(4 marks)**

$$\int_{-2}^{3} \left(x^2 + 3\right)\, dx$$

c) Integrate **(3 marks)**

$$\lim_{n\to\infty} \frac{5^{n+1} + 7^{n+1}}{5^n - 7^n}$$

d) Evaluate **(5 marks)**

Question Four

$y = x^2 + x$

a) Given the curve . Find the equation of the tangent and the normal at (2, 6) **(5 marks)**

b) A particle moves along the straight line in a way that its distance from a fixed point 0 on the line after

$s = \frac{1}{6}t^4$

t sec in 5m, where). Find

(i) Its velocity after 3 seconds and 4 seconds

(ii) Its average velocity after the 4th second

(iii) Its acceleration after 2 second and after 4 seconds

(iv) Its average acceleration from t = seconds t = 4 second **(8 marks)**

$f(x) = x\sin\frac{1}{x}, x \neq 0$ $f(0) = 0$

c) If given and find if it is continuity at the origin **(7 marks)**

Question Five

a) Given $y = 2xe^{-3x}$, show that $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + ay = 0$ **(8 marks)**

b) Find $f(3)$ if $f(x) = x^2 + 4$ **(3 marks)**

c) Find the equation of the line that passes through the point (5, 1) and whose slope is equal to ½ **(4 marks)**

d) Find $\lim_{x \leftarrow 1}, \frac{x^2 - 1}{x^2 - 3x + 2}$ **(5 marks)**