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:

BACHELOR OF TECHNOLOGY IN INDUSTRIAL CHEMISTRY (BTIC 12J)

AMA 4105: CALCULUS FOR SCIENCE

END OF SEMESTER EXAMINATION
SERIES: DECEMBER 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

Question One (Compulsory)

a) Find $\dfrac{dy}{dx}$ from first principle for the following functions.

(i) $y = 7x^4$ (7 marks)

(ii) $y = x\cos x$ (7 marks)

b) Differentiate w.r.t x if

$$e^y + x^3 = y^3 - 4$$

(4 marks)

c) Evaluate:

(i)

$$\int_{-1}^{1}(2x-1)^2\,dx$$

(3 marks)

(ii)

$$\int_{0}^{\pi/2}\cos 3x\ dx$$

(3 marks)

(iii)

$$\int_{0}^{1}5xe^{4x}\,dx$$

correct to 3 significant figures.

(6 marks)

Question Two

a) (i) Identify the maximum and minimum values of the function

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

(9 marks)

    (i)   Sketch the graph of the function in (i) and clearly show the maximum and minimum points on the sketch. **(5 marks)**

b) When viewed through a microscope a bacterium is seen to move in accordance with the equation.

$$s = \left(4t + 6t^2\right) \times 10^{-6}$$

Find:
(i)   The distance travelled between 0 and 45 seconds. **(2 marks)**
(ii)   The velocity after 30 seconds. **(3 marks)**
(iii)   The acceleration after 30 seconds. **(1 mark)**

Question Three

a) Evaluate

$$\int_{1}^{2} x\ln x\,dx$$

correct to 4 significant figures. **(7 marks)**

b) A gas expands according to the law.
     PV = Constant
     When the volume is 3m3, the pressure is 150kPa.

$$= \int_{V1}^{V2} Pdv,$$

Given that the work done   determine the work done the as the gas expands from 2m³ to 6m³. **(6 marks)**

c) Find the equation of (i) tangent **(4 marks)**
                          (ii) Normal **(3 marks)**

to the curve $y = 1 + x - x^2$ at the point (-2, -5)

Question Four

a) Determine the integral;

$$\int \frac{2x^2 - 9x - 35}{(x+1)(x-2)(x+3)}$$

(10 marks)

b) (i) Sketch the area enclosed by the curve $y = 4x - x^2$ and the x-axis, clearly indicating the turning point and intercepts on your sketch. **(7 marks)**

(ii) Find the area in (i) **(3 marks)**

Question Five

a) Differentiate the functions w.r.t x if:

(i) $x \tan y = y^3 \cos x$ **(6 marks)**

(ii) $x = t^2,\ y = t - 2t^2$ **(4 marks)**

b) Find the length of the curve $y^2 = x^3$ between x = 0 and x = 4. **(6 marks)**

c) Determine the area bounded by the curve $y = 3e^{t/4}$, the t-axis and ordinates at t = -1 and t = 4 correct to 4 significant figures. **(4 marks)**