TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 13M)

AMA 2151: ENGINEERING MATHEMATICS II

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

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Scientific Calculator*
- *Mathematical Table*

This paper consists of **FIVE** questions. Answer any **THREE** questions

Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One

a) From first principles, find first derivative for $x\cos x$ **(7 marks)**

b) Find $\frac{dy}{dx}$ given $10x^3y + \frac{x}{y} = 75x^3$ **(6 marks)**

c) A function is defined parametrically as $x = \sin t$ and $y = \cos t$ find the radius of curvature at the point $t = \frac{\pi}{4}$ where **(7 marks)**

Question Two

a) Using appropriate rules find $\frac{dy}{dx}$ given:

$$y = \frac{e^{3x}\cos 2x}{x\sin x}$$

(6 marks)

b) A closed cylinder is to be fabricated using a sheet metal. The cylinder will be of capacity $5m^3$:

(i) Determine dimensions of the cylinder if minimum surface area for the sheet to be used is considered.

(ii) Prove that the surface area is minimum at the dimension obtained. **(7 marks)**

c) (i) Find stationary points for the function:

$$y = 8x^3 - 24x + 11$$

(ii) Determine the nature for the stationary points in c(i) **(7 marks)**

Question Three

a) Find the gradient at the point x = 1 for the function $xy^2 + xy - 5 = 0$ **(7 marks)**

b) (i) Find turning points for the function:

$$y = x^3 - 3x^2 - 4x + 12$$

(ii) Sketch the function in b(i) given y = 0 when x = 2 **(13 marks)**

Question Four

Find $\frac{dy}{dx}$ for the following:

(i) $y \sin x + x \cos y = 10x^3 + 5$

(ii) $y = \arccos\left(x^4 - 5\right)$ **(7 marks)**

c) A moving particle covers distance sin meters during time t in seconds. The relationship formed is:
$s = 10t^3 - 5t^2 + 2t$

(i) Time taken when particle comes to rest
(ii) Time taken to attain an acceleration f 10m/s^2
(iii) Distance covered when object comes to rest **(8 marks)**

d) A closed rectangular tank of capacity 18m^3 is to be fabricated. The height of the tank is to be 1.8m:

(i) Find the dimensions of the tank considering minimum surface area of the material to used.
(ii) Show that the surface area is minimum at dimensions obtained. **(7 marks)**

Question Five

a) Find first derivative for:

(i) $xe^y + ye^x = x \tan y$

(ii) $y = arc \sinh\left(\frac{1}{x}\right)$ **(8 marks)**

b) Using logarithms determine $\frac{dy}{dx}$ given:

$$\frac{e^{x^2} \cos 2x}{\tan x}$$

(4 marks)

c) **(i)** A rectangular sheet of metal measures 25cm by 35cm. Squared pieces of the material area cut off from the four corners. An open box is formed when the sides are folded. Find the surface area of the box formed if it is a minimum.

(ii) Show that the surface area formed is a minimum **(8 marks)**