PAPER 2

TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

Department of Electrical & Electronics

UNIVERSITY EXAMINATION FOR:

Diploma in Electrical and Electronic Engineering

AMA 2151 ENGINEERING MATHEMATICS II

END OF SEMESTER EXAMINATION

SERIES: December 2016

TIME: Two HOURS

Instructions to Candidates

You should have the following for this examination

Answer Booklet, examination pass and student ID, Scientific Calculator & No Mobile Phone.

This paper consists of five questions. Attempt 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

Do not write on the question paper.

QUESTION ONE (COMPULSORY)

(a) Determine from first, principles the derinative $f(x) = \frac{1}{5x+3}$ (5 marks)

(b) Given $u = x^2y + \frac{y}{x}$ find du (3 marks)

(c) Given that $f(x) = x^2$ express as simply as possible

$$\frac{f(a+h) - f(a)}{h} \quad (h + 0)$$

(4 marks)

(d) If $x^3 + y^3 + 3xy^2 = 8$ find $\frac{dy}{dx}$ (4 marks)

(a) Evaluate $\int \sqrt{(a^2-x^2)}\, dx$ by putting $x = a\sin\theta$ (7 marks)

(b) Find the value of

$$\underset{x -}{\text{Lim}} \quad \frac{3x^2 + 4x - 2}{5x^2 - xr6}$$

by putting $x = \frac{1}{h}$ and h – 0. (3 marks)

(c) Determine $\int \frac{7x\,dx}{\sqrt{(8x^2+4)}}$ (4 marks)

QUESTION TWO:

(a) Find the gradient at the point (1, 2) on the curve $y = x^3+3x^2-x-1$ (3 marks)

(b) A box with sides of length x, y, zmm is expanding along the x and y sides at a rate of 2 and 3mm per second but contracting along the z side at a rate of 4mm per second. Find the rate of change of volume when x = y = 10mm, z = 20mm (5 marks)

(c) If $x = t^3 + t^2$, $y = t^2 + t$. Find $\frac{dy}{dx}$ in terms of t. (4 marks)

(d) Sketch the curves $y = 4 - x^2$ and $y = x^2 - 2x$, then find the area enclosed between the two curves (8 marks)

QUESTION THREE:

(a) Find the maximum and minimum of the function
$y = x^3 + 6x^2 - 36x + 5$ (6 marks)

(b) Find the equation of the normal to the curve $y = (x^2+x+1)(x-3)$ at the point where it cuts the x – axis. (Take x^2+x+1) as having no real roots) (5 marks)

(c) A pin moves along a straight guide so that is velocity v(cm/s) when it is distance x(cm) from the beginning of the guide at time t(s) is as given in the table below

t(s)	0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0
V(cm/s)	0	4.00	7.94	11.6	14.97	17.39	18.25	16.08	0

Apply Simpsons rule using 8 intervals, to find the approximate total distance travelled by the pin between t = 0 and t = 4 (9 marks)

QUESTION FOUR:

(a) Given $\text{Cos}^4\Theta = \frac{1}{4}(1 + \text{Cos}2\,\Theta)^2$
Evaluate $\int \text{Cos}4\Theta d\Theta$ (5 marks)

(b) The area of the segment cut off by Y = 5 from the curve $y = x^2 + 1$ is rotated about the x – axis. Find the volume generated (8 marks)

(c) Show that $V = (Ar^n + \frac{B}{r^n}) \cos (n\Theta- \;)$
Satisfies the equation

$$\frac{d^2y}{dr^2} + \frac{1}{rdr}dv + \frac{1}{r^2}\frac{d^2y}{d\Theta^2} = 0$$

(7 marks)

QUESTION FIVE:

(a) Evaluate (i) $\int x \sqrt{\;}(3x-1)dx$ by substitution (4 marks)

$\int \frac{x + 1}{x^2 - 3x+2} dx$ by partial fractions (5 marks)

(b) Given cash $x = \frac{1}{2}(e^x + e^{-x})$ and
Shinex $= \frac{1}{2}(e^x – e^{-x})$
Show that for $\tanh^{-1}x, = \frac{1}{2} \ln \left(\frac{1 + x}{1 – x} \right)$ (6 marks)

(c) Evaluate

$I = \int_1^3 \int_1^1 \int_0^2 (x + 2y-z)\, dxdydz$ (5 marks)