PP1

TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN ELECTRICAL & ELECTRONIC ENGINEERING

DIPLOMA IN MECHANICAL ENGINEERING

AMA2151 ENGINEERING MATHEMATICS 2

END OF SEMESTER EXAMINATION

SERIES: APRIL / MAY 2016 SERIES

TIME: 2HRS

DATE: APRIL / MAY 2016

Instructions to Candidates
You should have the following for this examination
-*Answer Booklet, examination pass and student IDMathematical table, calculator, no mobile phone*
This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE

a) (i) Differentiate from first principles $f(t) = kt4$ (3 Mks)

(ii) Given $x^3 + Y^3 - 3axy$ find $\frac{dy}{dx}$ (2Mks)

(iii) Find the gradient at the point (1, 1) on the curve

$$Y = \frac{(x^3 + 4x+1)}{(x^2 + 2x + 3)}$$ (4 Mks)

b) (i) If $f(x) = 4x^3 - 2x^2 - 3x+1$ find

$$\frac{f(1+b) - f(1)}{b}$$ (3Mks)

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

(iii) If S= a sinwt where a and w in are constants prove that

$$\frac{ds}{dt} = \pm w\sqrt{a^2 - s^2} \qquad \frac{d^2s}{dt^2} = -w^2 s$$ (4Mks)

c) (i) Evaluate

$I = \int (2x^3 - 5x^2 + 6x - 9)\,dx$ (2Mks)

(ii) Determine $\int_{\emptyset}^{\frac{\Pi}{2}} (\text{Sinx} - \text{cosx})dx$ (2Mks)

(iii) Sketch the graph $y=x^3+2x^2+x+1$ between x=-1 and x=2 and determine the area enclosed between the curve, the x-axii and between the x=-1 and x=2 (4Mks)

d) Find the mean value of $y=3x^2+4x+1$ between x=-1 and x=2 (2Mks)

QUESTION TWO

a) Find

(i) $\lim_{n\to\infty} \frac{3n^2-7n-10000}{2n^2+n-4}$ (3Mks)

(ii) Show that $\lim_{x\to\infty} \frac{3n}{2n+1} = \frac{3}{2}$ (3Mks)

(iii) Evaluate: $\text{Lim}_{x\to\infty} \frac{2+x}{3-7x}$ (3Mks)

b) (i) Determine algebraically, from first principles the gradient of the graph of $y=5x^2+2$ at the point p where x = -1.6 (4Mks)

(ii) Investigate the statutory points on the graph of $y=x^2 e^{-x}$ and sketch the curve (7Mks)

QUESTION THREE

a) (I) Given that $h(x) = x^2-x$ find the values of

(i) h(10) (2Mks)

(ii) h(t+1) (2Mks)

(iii)h(5k) (2Mks)

(II) If $f(x) = 7x$ and $g(x) = x+3$ and $fg : x \rightarrow y$ express as simply as possible the rule which maps x onto y. Find the values of p, q, r such that

i) $fg : 5 \rightarrow p$ (2Mks)

ii) $fg : 10 \rightarrow q$ (2Mks)

iii) $fg : r \rightarrow 35$ (2Mks)

b) (i) prove the identity $\cosh^2 x - \sinh^2 x = 1$ from the definition (3Mks)

(ii) Prove that $\sinh^{-1} x = \ln\{x + \sqrt{(1+x2)}\}$ (3Mks)

QUESTION FOUR

a) (i) Find $\int \frac{1}{\sqrt{(x2+2x+10)}}$ dx by completing the square and substitution of

$x+1 = 3\sin Ø$. (4Mks)

(ii) Find $I = \int \sqrt{(a^2-x^2)}dx$ by putting $x = a \sin Ø$ (4Mks)

b) (i) Integrate $\frac{1}{(x+1)^2(x+4)}$ (6 mks)

(ii) Find $I = \int x \sin x dx$ (3Mks)

(iii) If $\tanh x = 1/3$ what is scchx? (3Mks)

QUESTION FIVE

a) Evaluate

(i) $I = \int_1^2 \int_0^{II} \int_0^{II} 3 + \sin ø)dØdr$ (3Mks)

(ii) $I = \int_1^2 \int_0^3 \int_0^1 (p^2+q^2-r^2)dpdqdr$ (4Mks)

b) Show that

(i) $V = (Ar^n + B/r^n) \cos(nØ - \alpha)$

Satisfies the equation

$$\frac{d^2v}{dr^2} + \frac{1}{r}\frac{dv}{dr} + \frac{1}{r^3}\frac{d^2v}{d\theta^2} = 0$$ (6Mks)

(ii) If $z = \sin(x+y)$ where $x = \mu^2 + V^2$ and $y = 2\mu v$ find $\frac{dz}{d\mu}$ and $\frac{dz}{dv}$ (7Mks)