TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN ELECTRICAL & ELECTRONICS ENGINEERING (DEPE2, DEAE2, DICE2)

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*

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) Prove by definition that:
$\cosh^2 x - \sinh^2 x = 1$
(3 marks)

$\int_3^2 \cosh^{-1} x\,dx$

b) Evaluate **(3 marks)**

c) (i) Prove that if P is the perpendicular distance of 0 from line $ax + by + c = 0$ then $P = \frac{C}{\sqrt{a^2 + b^2}}$
(5 marks)

(ii) Find the perpendicular distance of (2, -3) from $3x = 4y - 7$ (**3 marks)**

$\int \frac{1}{\sqrt{(x^2 + 2x + 10)}}\,dx$

d) (i) Find by completing the square and substituting $x + 1 = 3\sinh\theta$
(5 marks)

(ii) Integrate $\sec hx$ with respect to x **(4 marks)**

$I = \int \sqrt{(a^2 + x^2)}\,dx$

e) Find by part and by putting $x = a\sinh z$ **(5 marks)**

$\int \sinh^3 \theta d\theta$

f) Find **(2 marks)**

Question Two

a) Find the equation of the line passing through (-3, 2) and (4, -5) **(3 marks)**

b) (i) Find the perpendicular distance of the point of intersection of the lines $2x - 3y + 4 = 0,\ x - 4y + 7 = 0$ from a line drawn through (2, 3) parallel to $2x + 3y + 4 = 0$
(4 marks)

(ii) Show that the equation of the tangent to the parabola $y^2 = 4ax$ at (x, y) is $yy_1 = 2a(x + x_1)$
(4 marks)

c) If $f(x) = 5x^2 - 3x + 1$, find $f(3) - f(2)$ **(3 marks)**

d) Find the equation of a line which passes through the point (1, -7) and (1) makes 45° with the x-axis, (2) is horizontal (3) is vertical (4) also passes through (4, 5) **(6 marks)**

Question Three

a) (i) Differentiate 10^x with respect to x **(3 marks)**

(ii) Find the gradient at the point (1, 6) on the curve $y = (x^2 + 1)(x^2 + 2)$ **(3 marks)**

b) Obtain the differential coefficient of $y = \sin(2 - 3x^2)$ **(4 marks)**

c) If $x^2 + y^2 - 2x - 6y + 5 = 0$ find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x = 3, y = 2 **(4 marks)**

d) (i) $y = \cos 2t,\ x = \sin t$ find $\frac{dy}{dx}$ **(3 marks)**

(ii) Differentiate with respect to x **(3 marks)**

$$y = e^{2x}\frac{\cos 3x}{\tan 4x}$$

Question Four

a) Sketch the graph of the function:

$$y = \frac{48}{12 + x^2}$$

and find the points of inflexion of the function **(5 marks)**

b) (i) Find $\int x\sqrt{(3x-1)}\,dx$ **(6 marks)**

(ii) Evaluate $\int_0^{\pi/4} \cos^3 x \sin x\,dx$ **(3 marks)**

c) Using substitution $x = \sin u$, find:

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

(3 marks)

d) Find the total volume formed when $y^2 = x^2(9 - x^2)$ rotates round the x axis given that volume is given by $V = \int_a^b \pi y^{2dx}$ **(3 marks)**

Question Five

a) (i) Simplify $\frac{1+\sinh A+\cosh A}{1-\sinh A-\cosh A}$ **(5marks)**

(ii) Factorize $x^2-2xych x+y^2$ using definition of cos h x **(4 marks)**

b) If $y=sh^{-1}\left(\frac{x}{a}\right)$ prove that $y=\log\left(\frac{x+\sqrt{a^2+x^2}}{a}\right)$ by first getting cosh y or otherwise **(4 marks)**

c) Evaluate $\tanh^{-1}0.623$ **(3 marks)**

d) Find an expansion for $\cos(x-jy)$ in terms of trigonometric and hyperbolic function of x and y **(4 marks)**