# TECHNICAL UNIVERSITY OF MOMBASA

# Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DEEE II/DEPE II/DTIE II/DICE II/DEAE II

AMA 2102: ENGINEERING MATHEMATICS II

**END OF SEMESTER EXAMINATION**
**SERIES:** APRIL 2013
**TIME:** 2 HOURS

**Instructions to Candidates:**

You should have the following for this examination

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

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 **FOUR** printed pages

**SECTION A (COMPULSORY)**

**Question One**

**a)** (i) If $17thx = 1/3$ find $e^{2x}$ and hence show that $x = 1/2 \log 2$ **(2 marks)**

(ii) **(2 marks)**

**b)** With help of a diagram, find the angle between $x - y + 1 = 0$ and $x + 4y + 1 = 0$ **(7 marks)**

**c)** Prove the following:

**(i)** $chx = 2ch^2 \frac{x}{2} - 1$ **(3 marks)**

**(ii)** $\coth^2 \theta - 1 = \cos ech^2 \theta$ **(3 marks)**

**d)** (i) Given $2\cos A\sin B = \sin(A+B) - \sin(A-B)$ determine $\int \cos 5x \sin 3x dx$ **(3 marks)**

(ii) $\int x^3 e^{2x} dx$ by substitution method. **(6 marks)**

**e)** Express in polar form:

**(i)** $\angle 110^o$

**(ii)** $\sqrt{140^o}$ **(2 marks)**

**SECTION B (Answer any TWO questions from this section)**

**Question Two**

**a)** (i) If $shx = 3/4$ what is $chx$ **(2 marks)**

(ii) Show that $\tanh^{-1} x = 1/2 \ln\left\{\frac{1+x}{1-x}\right\}$ **(3 marks)**

**b)** (i) Differentiate with respect to $\theta$ **(3 marks)**

$$t = 3(\theta + 2)^3 - 2\left(4\sin 6\theta + \frac{\cos 2\theta}{4}\right)$$

**(3 marks)**

(iii) Tabulate values of $e^x$ and $-e^{-x}$ and hence sketch graph $y = \sinh x$ **(5 marks)**

$$m = \int \frac{t^2 - 4t}{t} dt$$

**c)** (i) Determine the value of arbitrary constant of integration of and t = 2 when m = 4 **(2 Marks)**

(ii) Evaluate $\int \sin x \cos x dx$ **(2 marks)**

**d)** Find the area between the curve $y = x^2 - x + 2$ the ordinates x = - 1 and x = 2 and the x-axis. **(3 marks)**

**Question Three**

**a)** Find the differential coefficient of $y = 3x^2 \sin 2x$. **(4 marks)**

$$y = 3\cos 2t, \quad x = 2\sin t$$

**b)** The parametric equation of a function are given by
Determine expression for:

**(i)** $\frac{dy}{dx}$ **(2 marks)**

**(ii)** $\frac{d^2y}{dx^2}$ **(2 marks)**

$$y = \frac{(x+1)(x-2)^3}{x-3}$$

**c)** (i) Use logarithmic differentiation to differentiate **(4 marks)**

$$x = 3t^2 - 2t^2 + 4 - 1$$

(iii) The distance x metres moved by a car in a time t seconds is given by
Determine the velocity and acceleration when t = 0 and t = 1.5s

**Question Four**

**a)** Evaluate:

**(i)** sinh 1.275 **(2 marks)**

**(ii)** cosh 2.15 **(2 marks)**

$$4sh^3x = sh3x - 3shx$$

**b)** (i) Prove from the definition that **(4 marks)**

$$3ex + 4e^{-x} = Archx + Bshx$$

(ii) If

Find A and B **(4 marks)**

**c)** An alternating voltage is given by V = 80 sin 100t volts, where t is the time in seconds. Calculate the rate of change of voltage when:

$t = 0.01s$

**(i)** and **(2 marks)**

$t = 0.02s$

**(ii)** **(2 marks)**

$\frac{dy}{dx}$ $dy/dx$

**d)** Determine an expression for in each of the following cases and find the value of at the stated value of x.

$y = 3x^4 - 7x^3 + 4x^2 + 3x - 4 \ [x = 2]$

**(i)** **(2 marks)**

$y = 6x^3 - 7x^2 + 4x + 5 \ [x = 3]$

**(ii)** **(2 marks)**

**Question Five**

$$y = \frac{x^3}{3} - \frac{x^2}{2} - 2x + 5$$

**a)** (i) Find the stationary points on the graph of the function **(3 marks)**

(ii) Distinguish between them and sketch the graph of the function. **(3 marks)**

$$f(x) = \frac{1}{5x + 3}$$

**b)** Differentiate from first principles **(4 marks)**

$$x^2 + y^2 = 2ax$$

**c)** (i) Change the equation into polar coordinates **(2 marks)**

$$r^2 = a^2 \cos 2\theta$$

(ii) Change the equation in to Cartesian coordinates. **(2 marks)**

$\cosh x = 2sh^2x - 1$ $sh2x = 2shx\ chx$

**d)** (i) Using the identities of and

$$\frac{1 + shA + chA}{1 - shA - chA}$$

Simplify: **(3 marks)**

$$\cosh^{-1}(\sec x)$$

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