# TECHICAL UNIVERSITY OF MOMBASA

# Faculty of Engineering & Technology

### DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12 J)**
**DIPLOMA IN ARCHITECTURE (DA 12J)**

### AMA 2314: ENGINEERING MATHEMATICS

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

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
- *Mathematical Tables*
- *Scientific Calculator*

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)** Use L'Hospital's Rule to determine the limit of the following functions:

**(i)** $f(x) = \dfrac{\sin x - x}{\tan x - x}$ as $x \to 0$

**(ii)** $\lim\limits_{x \to \infty} \left( \dfrac{4x^2 - 5x}{1 - 3x^2} \right)$ **(5 marks)**

**b)** **(i)** Solve the following initial value problem (IVP) $y''+11y'+24y = 0,$ given $y(0) = 0,\ y'(0) = -7$ **(8 Marks)**

**(ii)** Show that $f(x) = \dfrac{1}{3}x^3 + 2x$ satisfies the hypothesis of the mean value theorem on the interval

(0, 3). Determine all the values of C. **(5 marks)**

**c)** Evaluate $L\left\{ \dfrac{1}{26} \right\}$ **(2 marks)**

**Question Two**

**a)** Use Laplace transform to solve the following IVP, $y''-10y'+9y = 5t$ given $y(0) = -1,\ y'(0) = 2$ ) **(10 Marks)**

**b)** **(i)** Evaluate $\int\limits_{1}^{2}\int\limits_{2}^{3}\int\limits_{0}^{1} 8xyz\ dzdx\ dy$ **(3 marks)**

**(ii)** Show that as $x \to 2,\ f(x) = \dfrac{x^2 - 4}{x - 2}$, has a limiting value of 4. **(3 marks)**

**c)** Evaluate: $L^{-1}\left\{ \dfrac{6}{s} - \dfrac{1}{s-8} + \dfrac{4}{s-3} \right\}$ **(4 marks)**

**Question Three**

**a)** (i) Evaluate

$$\int_{0}^{\sqrt{x2}} \int_{0}^{e^{x/y}} dy\, dx$$

**(4 marks)**

(ii) Evaluate:

$$\lim_{x \to \infty}\left(\frac{3n-2}{5n+4}\right)$$

**(4 marks)**

**b)** (i) Solve,

$$\frac{d^2 y}{dx^2} + 4\frac{dy}{dx} = 6$$

**(8 marks)**

(ii) Determine whether

$$\int_{-\infty}^{+\infty} \frac{4x^3 dx}{\left(1+x^4\right)}$$

**(4 marks)**

## Question Four

**a)** (i) A metallic box 5cm long, 3cm wide and 2.5cm high is influenced by temperature changes. Find the change in volume when the length is increased by 0.25 width is decreased by 0.15 and height is decreased by 0.05. **(4 marks)**

(ii) Use Taylor's series method to determine the value of $\tan 52°$ (6 decimal places). **(6 marks)**

**b)** (i) Given

$$u = \sin^{-1}\left\{\frac{x}{y}\right\} + \tan^{-1}\left\{\frac{y}{x}\right\}$$

find the value of

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$$

**(8 marks)**

(ii) Determine divergency or convergency, given

$$\int_{0}^{1} \frac{1}{\sqrt{x}} dx$$

**(2 marks)**

## Question Five

**a)** Using Laplace transform solve,

$$2y'' + 3y' - 2y = te^{-2t}, \ y(0) = 0, \ y'(0) = -2$$

**(10 marks)**

**b)** Evaluate:-

**i)**
$$L\left\{6e^{-5t} + e^{3t}\right\}$$

**ii)**
$$L\left\{4\cos(4t) + 9\sin(4t)\right\}$$

**(4 marks)**

**c)** (i) Evaluate $\displaystyle\int \tan^n x\, dx$ **(4 marks)**

(iii) Test for convergency, given:

$$\int_0^1 \ln x\, dx$$

**(2 marks)**