TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN ELECTRICAL POWER ENGINEERING (DEPE V)

AMA 2301: ENGINEERING MATHEMATICS V

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: MARCH 2014
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*
- *Mathematical Table*
- *Scientific Calculator/Drawing Instruments*

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 **THREE** printed pages

SECTION A (COMPULSORY)

Question One

a) (i) Given that $f(z) = xy^2 + ix^2y$ find the point where the canehy-Riemann equations area satisfied for the function. **(5 marks)**

(ii) Determine if $z = 2xy + i(x^2 - y^2)$ is analytic **(6 marks)**

b) (i) Find the fourier series to represent $f(x) = \begin{cases} x + \bar{u} & for \quad 0 \le x \le \bar{u} \\ -x - \bar{u} & -\bar{u} \le x \le 0 \end{cases}$ **(8 marks)**

(ii) Represent the following function by a half range fourier sine series.

$$f(x) = \begin{cases} x & 0 < x \le \frac{\pi}{2} \\ \frac{\bar{u}}{2} & \frac{\pi}{2} < x \le \pi \end{cases}$$

(7 marks)

c) Devise a fixed iteractive schemes to find the roots of the quadratic equation:

$2x^2 - 24x + 41 = 0$ and test them numerically using Newton-Raphson iterative method. **(4 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) Express the function $w = f(z) = z^2 + 2z - 3z$ in the form $w = f(z) = u(x, y) + iV(x, y)$ then find the value of $f(1+i)$

b) Find the image $|z - 3i| = 3$ under the mapping $w = \frac{1}{z}$ **(7 marks)**

c) Prove that $u = x^2 - y^2$ and $v = \frac{y}{x^2 + y^2}$ are harmonic functions of (x, y) but are not harmonic conjugates. **(7 marks)**

Question Three

a) A function $f(x)$ is defined as

$$f(x) = \begin{cases} 0 & -5 < x < 0 \\ 5 & 0 < x < 5 \end{cases}$$

$f(x+10)$

- **(i)** Sketch the function for at least three periods
- **(ii)** State whether the function is odd, even or neither
- **(iii)** Determine the Fourier series.

b) A periodic wave function if fig 1 below represents an electromotive force in an electric circuit.

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- **(i)** Determine the analytic representation of the wave hence resulting Fourier series
- **(ii)** Using a suitable substitution and the series in b(i) above show that:

$$\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$$

Question Four

a) Solve $f(x) = x^3 + 4x^2 - 10 = 0$ using Newton's method. **(8 marks)**

b) Use the interaction method to solve $f(x) = x - \cos x = 0$ **(12 marks)**

Question Five

a) Given that x_n is an approximation to the root of the equation $x^3 - 2x^2 + 2 = 0$ show using Newton Raphson method that an approximation x_{nr1} is given by:

$$\frac{x_{n+1} = 2x_n^3 - 2x_n^2 - 2}{3x_n^2 - 4x_n}$$

Hence by taking $x_0 = -0.85$ find to five decimal places the root of the equation. **(8 marks)**

b) Given the table below, use Newton-Gregory interpolation formula to determine:

(i) $f(-3)$

(ii) $f(4)$

x	-2	-1	0	1	2
f(x)	-10	0	4	8	18