TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

DIPLOMA IN ELECTRICAL POWER ENGINEERING

AMA 2301: ENGINEERING MATHEMATICS V

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 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 **THREE** printed pages

SECTION A (COMPULSORY)

Question One

a) (i) Given that $f(z) = xy^2 + ix^2y$ find the point where Canchy-Riemann equations are satisfied for the function

(ii) Determine if $z = 2xy + i(x^2 - y^2)$ is analytic **(5 marks)**

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

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

$$f(x) = \begin{cases} x, & 0 < x \le \dfrac{\pi}{2} \\ \dfrac{\pi}{2}, & \dfrac{\pi}{2} < x \le \pi \end{cases}$$

(7 marks)

c) Devise a fixed iteractive schemes to find the roots of the quadratic equation: $2x^2 - 24x + 4x = 0$ 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 $w = f(t) = z^2 + 2z - 3z$ in the form: $w = f(z) = u(x, y) + iV(x, y)$

Then find the value of f(1 + i)

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

c) Prove that $u = x^2 - y^2$ and $v = \dfrac{y}{x^2 + y^2}$ are harmonic functions of (x, y) but are not harmonic conjugates. **(8 marks)**

Question Three

$$f(x) = \begin{cases} 0 & -5 < x < 0 \\ 5 & 0 < x < 5 \end{cases} \quad f(x+10)$$

a) A function f(x) is defined as

(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.

(i) Determine the analytic representation of the wave hence resulting fourier series.

(ii) Using a suitable substitution and the series in b(1) 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) Using the interaction method to solve **(12 marks)**
$f(x) = x - \cos x = 0$

Question Five

a) Given that x_n is a approximation to the root of the equation $x^3 - 2x^2 + 2 = 0$, show using Newton-Raphson method that an approximation $x_n r_1$ is given by:

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

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) **(12 marks)**

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