TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN ELECTRICAL ENGINEERING (POWER OPTION)
DIPLOMA IN TELECOMMUNICATION ENGINEERING
DIPLOMA IN INSTRUMENTATION & CONTROL ENGINEERING

AMA 2350: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 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

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)

$$U = x^2 - y^2 + e^x \cos y + 8$$

a) Given that

(i) Show that U is harmonic

$$f(z) = u + jv$$

(ii) Find a function V such that is analytic. **(8 marks)**

$$x_n = 1.2345, \quad x_{n+1} = 1.2447$$
$$x_{n+2} = 1.3124, \quad x_{n+3} = 1.3233$$
$$f(x_n) = 12.5674, \quad f(x_{n+2}) = 13.9831$$

b) Given that

Use linear interpolation and linear extrapolation to calculate $f(x_{n+1})$ and $f(x_{n+3})$ to five d.p **(6 marks)**

c) The value of x and *f(x)* for a given polynomial function are shown below:

x	-1.2	-0.7	-0.2	0.3	0.8	1.3	1.8
f(x)	1.407	2.292	2.127	1.662	1.647	2.832	5..967

Apply the method of Newton-Gregory to estimate:

(i) $f(-0.39)$

(ii) $f(1.68)$ **(9 marks)**

d) Determine half-range Fourier sine series for the function $f(x) = 3x \;\; 0 \le x \le \pi$ **(7 marks)**

Question Two

A function f(x) is defined as:

$$f(x) = \begin{cases} \frac{1}{2} & -\pi \le x < 0 \\ x/2 - \frac{1}{2} & -1/2, \;\; 0 \le x \le \pi \end{cases},$$

a) Sketch the function for at least three periods **(3 marks)**

b) State whether the function is odd, even or neither. Give reasons for your answer. Hence. **(1 mark)**

c) Obtain the Fourier series for the function f(x) **(16 marks)**

Question Three

a) Apply Newton-Raphson iterative formula to show that from the equation:

$$x^4 - x^3 - 2x - 34 = 0$$

$$x_{n+1} = \frac{3x_n^4 - 2x_n^3 + 34}{4x_n^3 - 3x_n^2 - 2}$$

Hence calculate the root of the equation starting at $x_o = 3$ correct to six decimal places. **(9 marks)**

b) Use Newton-Gregory forward difference formula to obtain a polynomial of minimum degree that will exactly fit the data below hence or otherwise evaluate f(10) **(11 marks)**

x	-6	-4	-2	0	2	4	6
f(x)	1149	189	-3	-3	-3	189	1149

Question Four

a) Given that $f(z) = -\frac{1}{\pi}\ln z + j$ express *f(z)* in the form $u + jv$ hence show that u and v are harmonic. **(12 marks)**

b) A circle $|Z| = 1$ in the z-plane is mapped onto the W-plane by $W = \frac{1}{z-2}$. Determine its image in the w-plane. **(8 marks)**

Question Five

a) Sketch the following functions for at least three periods, stating whether .,the function is odd, even or neither. Give reason for your answer.

$$f(x)=\begin{cases}1 & -\pi<x<0\\ x & 0<x<\pi\end{cases}$$

(i) **(2 marks)**

$$f(x)=x,\ -\pi<x<\pi$$

(ii)

(2 marks)

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

(iii) **(2 marks)**

$$f(x)=x^2,\ -\pi<x<\pi$$

b) Sketch the function and show that as Fourier series, the function can be expressed as:

$$fx=x^2=\frac{\pi^2}{3}+4\sum(-1)^n\frac{\cos nx}{n^2}$$

(14 marks)