TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSISCS

DIPLOMA IN ELECTRICAL POWER ENGINEERING
DIPLOMA IN TELECOMMUNICATION & INFORMATION ENGINEERING
DIPLOMA IN INSTRUMENTATION & CONTROL ENGINEERING

AMA 2350: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION
SERIES: APRIL 2015
TIME ALLOWED: 2 HOURS

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

a) Given that
$$U = x^2 - y^2 + e^x \cos y + 8$$

    (i) Show that U is harmonic **(4 marks)**

    (ii) Find the function V such that $f(z) = U + jV$ is analytic where U is as in (i) **(4 marks)**

b) Given that x_n is an approximation to the root of the equation $x^4 + 5x - 20 = 0$

    (i) Show using Newton-Raphson method that a better approximation is given by:
$$x_{n+1} = \frac{3x_n^4 + 20}{4x_n^3 + 5}$$

    (ii) Taking the first approximation $x_o = 1.9$ find to five d.p the root of the equation **(4 marks)**

c) Test the analyticity of $f(z) = w = \sin z$ **(4 marks)**

d) Expand $f(x) = x \quad 0 \le x \le 3$ half range Fourier:

    (i) Sine series **(5 marks)**
    (ii) Cosine series **(5 marks)**

Question Two

a) Table 1 satisfies the function:

x	-2	0	2	4	6	8	10
f(x)	6	8	10	60	206	496	978

    Use Newton-Gregory forward difference formula to determine the value of:
    (i) f(-1.8)
    (ii) f(8.2) **(12 marks)**

b) Determine half range sine series for the function $f(x) = \cos x$ in the range 0 to π **(8 marks)**

Question Three

a) Show that $f(z) = z^3$ is analytic everywhere in the entire z- plane **(7 marks)**

b) Show that $U = \frac{1}{2} \ln(x^2 + y^2)$ is harmonic and determine the conjugate harmonic V **(13 marks)**

Question Four

a) Use Newton-Raphson Formula to obtain the root of the equation $x^3 - 5x + 3 = 0$ taking $x_o = 1.0$. Give the answer correct to five decimal places **(8 marks)**

b) Use Newton-Gregory Formula difference formula to obtain a poly nomial of minimum degree which will exactly fit the data given below.

x	-0.5	0.0	0.5	1	1.5
f(x)	1.327	1.382	1.416	1.452	1.513

Hence evaluate:

(i) $f(0.25)$

(ii) $\int_0^1 f(x)dx$ correct to four d.p **(12 marks)**

Question Five

a) Sketch the following function for at least three period and state whether odd, even or neither.

(i)
$$f(x) = \begin{pmatrix} x + \pi & -\pi < x < 0 \\ \pi - x & 0 < x < \pi \\ f(x + 2\pi) \end{pmatrix}$$
(3 marks)

(ii)
$$f(t) = \begin{pmatrix} t^2 & -\pi < t < 0 \\ -t^2 & 0 < t < \pi \\ f(t + 2\pi) \end{pmatrix}$$
(3 marks)

b) A function f(t) is defined by:

$$ft = \begin{cases} 0 & -2 < t < 0 \\ t & 0 < t < 2 \\ f(t + 4) \end{cases}$$

Obtain the Fourier series for the function **(14 marks)**