



TECHNICAL UNIVERSITY OF MOMBASA
Faculty of Applied & Health
Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS
DIPLOMA IN ELECTRICAL POWER ENGINEERING

AMA 2301: ENGINEERING MATHEMATICS V

END OF SEMESTER EXAMINATION

SERIES: AUGUST 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) State the Cauchy Rimann Equations: **(2 marks)**

$$w = x^2 + ay^2 - 2xy + j(bx^2 - y^2 + 2xy)$$

(ii) Determine the constant a and b in order that the C – R equations: should satisfy **(5 marks)**

b) Use Newton Raphson the ratio formula to determine the cube root of 123 correct to five decimal places. **(5 marks)**

c) Given from the following table, evaluate f(3.8) using Newton-Backward interpolation formula.

x	0	1	2	3	4
f(x)	1	1.5	2.2	3.1	4.6

(6 marks)

d) (i) Sketch the following functions for at least three periods stating whether the function is odd, even, or neither giving reasons for your answer.

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

(i) **(2 marks)**

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

(ii) **(2 marks)**

$$f(x) = 3 \quad 0 < x < \pi$$

(iii) Determine half-range Fourier sine series for **(8 marks)**

SECTION B (Answer any TWO questions from this section)

Question Two

a) Find the Fourier expansion of the period function of period 2π
 $f(x) = x^2, -\pi \leq x \leq \pi$ **(10 marks)**

b) Find the Fourier half range even expansion of the function:
 $f(x) = \left(\frac{-x}{l}\right) + 1, 0 \leq x \leq l$ **(10 marks)**

Question Three

$$u(x, y) = x^2 - y^2 + x$$

- a) Given the function
- Show that u is Harmonic
 - Determine a harmonic conjugate function $V(x,y)$ such that $f(z) = u + jv$ is analytic. **(10 marks)**

- b) Find the image of the circle $|z| = 2$ in the $w -$ plane under a transformation $w = \frac{z + j}{z - j}$ **(10 marks)**

Question Four

- a) Sketch the following functions for at least 3 periods:

$$f(x) = \begin{cases} \sin x & 0 < x < \pi/2 \\ 1/2 & \pi/2 < x < 3\pi/2 \\ 0 & 3\pi/2 < x < x\pi \end{cases}$$

- (i) **(3 marks)**

$$f(x) = \begin{cases} x & 0 < x < \pi/2 \\ x - \pi/2 & \pi/2 < x < 3\pi/2 \\ 4\pi - 2x & \frac{3\pi}{2} < x < 2\pi \end{cases}$$

- (ii) **(3 marks)**

- b) Establish the Fourier series for the function in figure 1 hence evaluate its Fourier series: **(14marks)**

(14 marks)

Question Five

- a) Using the Newton's Raphson method find the square root of 3 correct to 6 dp. **(5 marks)**

- b) Determine the Fourier series for the function $f(\theta) = \theta^2$ in the range $-\pi < \theta < \pi$ the function has a period of 2π **(8 marks)**

- c) Test the analyticity of the function $w = \sin z$ and hence derive that $\frac{d}{dz}(\sin z) = \cos z$ **(7 marks)**