



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN MECHANICAL, ELECTRICAL, BUILDING AND

CIVIL ENGINEERING

YEAR III SEMESTER II

AMA 2351: ENGINEERING MATHEMATICS VI

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2HOURS

DATE: Pick Date December 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID Mathematical table, calculator

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions

Do not write on the question paper.

Question one (compulsory) (30MKS)

a) Given $f(3)=0.3$ and $f(3.6)=0.65$ use linear interpolation to estimate $f(3.25)$ [5mks]

b) The table below shows an experimental data.

x	0	1	2	3	4
f(x)	1	7	23	55	109

- i. Develop a difference table [2mks]
- b. determine $f(0.5)$ using Newton –Gregory forward difference formula [5mks]
- c) Evaluate $\iint_D y \, dA$ where D is the region described by: $-1 \leq x < 1$ and $0 \leq y < \sqrt{1-x^2}$ [5mks]
- d) Using Newton- Raphson method, Determine the root of $x^3 - 3x + 1 = 0$ in the vicinity of $x=0.5$ correct to 5 Decimal [6mks]
- e) Verify whether the function $f(z) = e^x(\cos y + i \sin y)$ is analytic [3mks]
- f) Is the function $f(z) = e^x(\cos y - i \sin y)$ harmonic? [4mks]
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QUESTION TWO

- a) Show that $f(z) = e^z$ is analytic [6mks]
- b) Evaluate the line $\oint_C y^3 dx - x^3 dy$ using Green's where C is the positively oriented circle of radius 2 centered at the origin. [7mks]
- c) Use double integrals to find the area enclosed $y = x^3 + 4x, y = 0, x = 0$ and $x = 4$ (7Mk s)

QUESTION THREE

- a) Compute the integral $\iint_D xy^2 \, dA$ where D is a rectangle defined by $0 \leq x < 2$ and $0 \leq y < 1$ [5MKS]
- b) Calculate the volume under the surface $z = 3 + x^2 - 2y$ over the region D defined by $0 \leq x \leq 1$ and $-x \leq y \leq x$. [7MKS]

- c) Given the following data, estimate $f(1.8)$ using Newton-Gregory difference interpolation polynomial: [8mks]

i	0	1	2	3	4
x_i	1.0	3.0	5.0	7.0	9.0
f_i	0	1.0986	1.6094	1.9459	2.1972

QUESTION FOUR

- a) Show that the function $f(z) = (x^3 - 3xy^2) + j(3x^2y - y^3)$. Satisfy the Cauchy –Riemann equations [5MKS]
- b) Given the following data, estimate $f(2.2)$ using Newton-Gregory forward difference interpolation polynomial: [6mks]

x	0	1	2	3	4
$f(x)$	1	2	4	8	16

- c) Find the volume enclosed by the curve $x^2 + y^2 = 16$, and the planes $z = 0$ and $z = 5 - x$ (9marks)

QUESTION FIVE

- a) Verify if the complex function $f(z) = \frac{1}{z}$ is analytic [7mks]
- b) Find the image of the circle $|z| = 2$ by the transformation $w = z + 3 + 2j$ [4mks]
- Hence sketch its image in the w -plane (2marks)
- c) Show that the function $4xy - 3x + 2$ is harmonic and hence determine its conjugate harmonic function [7mks]