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: DEC 2016

TIME: 2HOURS

DATE: Pick Date DEC 2016

Instructions to Candidates

You should have the following for this examination

-*Answer Booklet, examination pass and student I 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)

1. a) Given the function $u(x,y) = x^2 - y^2 + x$

i) Show that $u(x,y) = x^2 - y^2 + x$ is harmonic. (3marks)

ii) Determine a harmonic conjugate function $v(x,y)$ such that $f(z) = u + jv$

is analytic. (4marks)

b) Show that $f(z) = z^3$ is analytic everywhere in the entire region in the z-plane. (5marks)

c) Using Newton- Gregory interpolation formula, evaluate $f(1.03)$ correct to six decimal places.

x	1	1.05	1.10	1.15	1.20
F (x)	1	1.257625	1.531	1.820875	2.128

(8marks)

d) i) Use double integrals to find the area enclosed $y = x^3 + 4x, y = o, x = 0$ *and* $x = 4$ (6marks)

ii) Evaluate $\int_0^1 dx \int_0^x dy \int_o^y dz$ (4marks)

QUESTION TWO

a) Use Newton-Gregory forward difference formula and the data below to compute

i) $f(17.5)$ 6marks

ii) $f(35.5)$ Correct to three decimal places (6marks)

x	10	15	20	25	30	35	40
F(x)	1736	2588	3420	4226	5000	5736	6428

b) (i) Given that x_n is an approximation to the root of the equation $x^3 - 4x^2 + 4 = 0$

Show using Newton –Raphson iterative method that a better approximation is

given by $x_{n+1} = \dfrac{2x_n^3 - 4x_n^2 - 4}{3x_n^2 - 8x_n}$

ii) Hence by taking $x_\circ = 0.5$, find the root of the equation correct to SIX d.p (8marks

QUESTION THREE

5. a) State Greens Theorem (3mraks)

(b) Using Greens theorem evaluate $\oint_c \left\{(x^2+y^2)dx+(x+2y)dy\right\}$ taken round the boundary curve c defined by

$y=0 \qquad 0\le x\le 2$

$x^2+y^2=4, \qquad 0\le x\le 2$

$x=0 \qquad 0\le y\le 2$ (10marks)

c) A function $f(x,y)=x^2+y$ is defined on the rectangular region $0\le x\le 1, 1\le y\le 2$

show that $\int_1^2\int_0^1 f(x,y)dx\,dy=\int_1^2 dy\int_0^1 f(x,y)dx=\int_0^1 dx\int_1^2 f(x,y)dy=\frac{11}{6}$ (7marks)

QUESTION FOUR

a) Find the volume enclosed by the curve $x^2+y^2=16$, and the planes

z = 0 and $z=5-x$ (8marks)

b) Evaluate:-

I) $\int_1^3\int_0^{\ln y} dxdy$ (5marks)

II) $\int_0^{\frac{\pi}{2}}\int_0^x x\sin y\,dydx$ (7marks)

QUESTION FIVE

a (i) State the Cauchy-Riemann Equations 1mark

(ii) Verify that the following function satisfies the Cauchy-Riemann equations and express the derivative of W = f (z) as a function of Z

$$W = f(z) = \left(x^3 - 3xy^2 + y\right) + j\left(3x^2 y - y^3 - x\right)$$ 8marks

b) The circle $|z| = 2$ in the Z-plane is mapped onto the w-plane under a transformation

$w = \dfrac{1}{z-1}$. Determine the image of the circle in the w plane (11marks)