(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: **MAT 304**

COURSE TITLE: COMPLEX ANALYSIS I

DATE: 12/10/18 **TIME:** 8 AM -10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE: COMPULSORY (30 MARKS)

a) Given $f(z) = \sin z$, find the Maclaurious series (5 marks)

b) If z_1 and z_2 are complex numbers, prove that
$|z_1 + z_2| \leq |z_1| + |z_2|$ (6 marks)

c) For which values of Z is the function continuous $f(z) = \frac{z}{(z-i)(z+i)}$ (4marks)

d)Giventhat $w = f(z) = z^2$, find the values of w that correspond to
$z = -3 + i5$ (4 marks)

e) Evaluate $\oint_c \frac{e^z}{(z+1)^2} dz$ where c is the circle $|z - 1| = 3$ (7 marks)

f) Determine the poles of the function $f(z) = \frac{z^2}{(z-1)^2 (z+2)}$ (4 marks)

QUESTION TWO (20 MARKS)

a) Evaluate $f(z) = \frac{1}{1-z}$ at $a = 3$ using Taylors' series
(6 marks)

b) State and prove the Residue Theorem (5marks)

c) Find the residues of $f(z) = \dfrac{z^2 - 2z}{(z+1)^2(z^2+4)}$ at all its poles in the finite plane and hence evaluate $\oint_c f(z)dz$ (9marks)

QUESTION THREE (20 MARKS)

a) Evaluate $\int_{1+i}^{2+3i} (z^2 + z)dz$ along the line joining the points (1, -1) and (2, 3)
(6marks)

b) Evaluate $\oint_c \frac{2z-1}{z(z+1)(z-1)} dz$, where c is the *circle* $|z| = 2$ (7 marks)

c) Evaluate the integral $\int_0^{4+2i} \bar{Z}\, dz$ along the curve $Z = t^2 + it$ (7 marks)

QUESTION FOUR (20 MARKS)

a) Find the first four terms of the Taylor series expansion of $f(z) = \ln(1 + z)$ about the point $z = 0$ (7 marks)

b) Using Cauchy's integral formula, evaluate $\int_c \frac{2z^2 + z}{z^2 - 1} dz$ where C is $|z-1| = 1$
(7 marks)

c) If $f(z)$ is analytic within and on simple closed curve C and if a is any point within C, show that $f(a) = \frac{1}{2\pi i} \oint_c \frac{f(z)}{z-a} dz$ (6 marks)

QUESTION FIVE(20 MARKS)

a) Evaluate $\oint_C \frac{3z^2 + z}{z^2 - 1} \, dz$ where C is a circle $| z - 1 | = 1$ (10 marks)

b) Locate and name the singularities in the finite Z-plane $f(z) = \frac{z}{(z^2 + 4)^2}$ and determine whether it is isolated singularity or not . (10 marks)