(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION

COURSE CODE: **MAA 225**

COURSE TITLE: **COMPLEX ANALYSIS I**

DATE: 19/05/2022 **TIME:** 2:00 PM - 4:00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

a) Define and give an example of following types of singularities

(i) Connectedness (2 mks)

(ii) Neighborhood (2 mks)

(iii) Limit point (2 mks)

(iv) Point set (2 mks)

(v) Complex function (2 mks)

(b) Convert the following into polar co-ordinates

(i) z= 3+2i (3 mks)

(ii) z= -2+3i (3 mks)

(c)(i)State De-moivres theorem and use it to prove that

$cos3\alpha = cos^3\alpha - 3cos\alpha sin^2\alpha$ and $sin3\alpha = 3cos^2\alpha - sin^3\alpha$ (6 mks).

(ii) Solve the equation $x^4 = 1$. (8 mks)

QUESTION TWO (20 MARKS)

(i) Show that for the complex variable z , the following formula is valid ;

$\cos^2 z + sin^2 z = 1$ (8 mks)

(ii) Prove that $sin(z_1 + z_2) = sinz_1 cosz_2 + cosz_1 sinz_2$ (8 mks)

(iii) Using the definition of Limit ,show that ;

$Lim_{z\to i}(7z - 1) = 7i - 1$ (4 mks)

QUESTION THREE (20 MARKS)

(a) (i)Let $W = f(z) = z^2$, find the value of W which corresponds to $z = -2 + i$ and show the correspondence can be represented graphically . (5 mks)

(ii) Prove that $1 - tanh^2 z = sech^2 z$ (5 mks)

(b) Show whether the following functions are analytic or not in the entire complex plane ;

(i) $W = e^z$ (5 mks)

(ii) $f(z) = x^2 - y^2 + i(3x^2y - y^3)$ (5 mks)

QUESTION FOUR (20 MARKS)

(a) Evaluate $\int_{0,3}^{2,4}(2y + x^2)dx + (3x - y)dy$ along

(i) The parabola $x = 2t$, $y = t^2 + 3$ (6 mks)

(ii)Straight lines from (0,3) to (2,3)and then from (2,3) to (2,4) . (5 mks)

(iii) Straight line from (0,3) to (2,4) . (5 mks)

(b) Define the following terms ;

(i) Simply connected (2 mks)

(ii) Multiply connected (2 mks)

QUESTION FIVE (20 MARKS)

(a) Evaluate $\oint_c(5x + 6y - 3)dx + (3x - 4y + 2)dy$ around a triangle in the xy plane with vertices at (0,0) and (4,3). (10 mks)

(b)Prove that the series $z(1 - z) + z^2(1 - z) + z^3(1 - z) + ...$ converges for $|z| < 1$ and find its sum. (10 mks)