**NATIONAL OPEN UNIVERSITY OF NIGERIA**
**Plot 91, Cadastral Zone, Nnamdi Azikwe Expressway, Jabi, Abuja**
**FACULTY OF SCIENCES**
**DEPARTMENT OF MATHEMATICS**
**September Examination, 2020_1**

**Course Code: MTH 305**
**Course Title: Complex Analysis II**
**Credit Unit: 3**
**Time Allowed: 3 Hours**
**Instruction: Answer Question Number One and Any Other Four Questions**

1a. Define Complex variable and transformation **(4marks)**

b. Discuss 4 elementary functions of Complex Variables. **(8marks)**

c. What do you understand by limit and continuity of functions of complex variables? **(6marks)**

d. What are the theorems on continuity? State them. **(4marks)**

2a.. Explain the following Classification of singularities:

i. Poles
ii. Removable singularities
iii. Essential singularities
iv. Branch Points
v. Singularities of Infinity. **(10marks)**

b. Differentiate between Simply and Multiply Connected Regions. **(2marks)**

3a. Differentiate between an Infinite series and sequence. **(2marks)**

b. Expand f(z) = Cos z in Taylor' series about z = π/4 and determine its region of convergence. **(10marks)**

4a. State the Green's theorem in the Plane. **(2marks)**

b. Using a circular contour of unit radius , prove that $\int_0^{2\pi} \frac{d\theta}{5+\sin\theta} = \frac{\pi}{2}$ **(10marks)**

5a. State the Harmonic Function **(2marks)**

b. Expand $f(z) = \dfrac{1}{z-3}$ as a Laurent series valid for

i. $|z| < 3$

ii. $|z| > 3$ **(10marks)**

6a. Prove that f(z) is analytic for $|z| < R$ with $f(z) = \sum_{n=0}^{\infty} a_n Z_n$ then, if $M_r$ is the supremum of $|f(z)|$ on the circle $|z| = r < R$, then $|a_n| < M_r / r^n$. **(3marks)**

b. Find the Taylor's series expansion of the function of the complex variable $f(z) = \frac{1}{(z-1)(z-3)}$ about the point z = 4 for order 3. **(9 marks)**