NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES

DEPARTMENT OF PHYSICS

2024_2 EXAMINATION

COURSE CODE: **PHY313**
COURSE TITLE: **MATHEMATICAL METHODS FOR PHYSICS I**
CREDIT UNIT: **3**
TIME ALLOWED: **(3 HRS)**

INSTRUCTION: ***Answer question 1 and any other THREE questions***

QUESTION 1

(A) (i) State De Moivre's theorem **[3 marks]**

(ii) Write the suitable nth root equation for $z^{1/n}$ **[4 marks]**

(B) Show that the solution of the complex variable z in term of x and y for

$|\cos z|^2 = \cos^2 x + \sinh^2 y$ **[10 marks]**

(C) Given a complex function $U(x, y) = x^3 - 3xy^2$, obtain its harmonic conjugate **[8 marks]**

QUESTION 2

(A) Distinguish between (i) Analytical and **[3 marks]**

(ii) Singular function **[2 marks]**

(B) Express $f(z) = z^5 + 4z^2 - 6$ in polar form **[10 marks]**

QUESTION 3

(A) (i) Explicitly, write out the mathematical residue formulation **[3 marks]**

(ii) Deduce, the residue equation for a simple pole **[2 marks]**

(B) Obtain the residue of the function $\dfrac{1}{z(z+2)^3}$ **[10 marks]**

QUESTION 4

(A) What is Cauchy integral formula **[6marks]**

(B) Evaluate $\oint_C \dfrac{\cos z}{z(z^2+8)}$ using the Cauchy integral, such that C denotes the boundary x and $y = \pm 2$ **[9 marks]**

QUESTION 5

(A) Prove that $\dfrac{d}{dz}\bar{z}$ is not analytic. **[7 marks]**

(B) Given $w = \dfrac{1}{1-z}$, obtain the function $U(x, y)$ and $V(x, y)$ **[8marks]**

QUESTION 6

(A) Using Green theorem, establish Cauchy Riemann Relation **[8marks]**

(B) If $z^c = e^{c \log z}$, find $\frac{d}{dz} z^c$ **[7marks]**