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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2020_2 EXAMINATIONS

COURSE CODE:	**PHY 313**
COURSE TITLE:	**MATHEMATICAL METHODS FOR PHYSICS I**
CREDIT UNIT:	**3**
TIME ALLOWED:	**(2½ HRS)**

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

QUESTION 1

Verify that:

a. a(√2 – i) – i(1 - √2i) = - 2i (2mks)
b. (2 – 3i)(- 2 + i) = -1 + 8i (3mks)
c. Reduce the quantity $\frac{5i}{(1-i)(2-i)(3-i)}$ to a real number (3mks)
d. Show that
- Re(iz) = -Imz (2mks)
- Im(iz) = Re(z) (2mks)

e. Write the following functions f(z) in the forms f(z) = u(x, y) + iv(x, y) under Cartesian coordinates with u(x, y) = Re (f(z) and v(x, y) = Imf(z), f(z) = z^3 + 2 + 1 (4mks)
f. Show that if f(z) is continuous at Zo, so is |f(z)| (5mks)
g. What is a complex exponential function for Z = x + iy (1mk)

QUESTION 2

Evaluate the following integrals:

a. $\int_1^2 (t2 + i)2\,dt$ 3mks
b. $\int_0^{\pi/4} e - 2it\ \ dt$ 3mks
c. Express this equation in the form of x + iy with x, y ∈ ℝ

$\frac{i}{1-i} + \frac{1-i}{i}$ 4mks

d. What are the two methods are used for criterion for convergence? 2mks

QUESTION 3

a. If C is the boundary of a triangle with vertices at the points 0, 3i and -4 oriented counter clockwise compute the contour integral $\int_C (e^2 - \dot{z})dz$ 5mks

b. What is the associative law for multiplication of complex numbers 2mks

c. Show that $(z_1z_2)z_3 = Z_1(Z_2Z_3)$ for all Z_1, Z_2, $Z_3 \epsilon \mathbb{C}$ 5mks

QUESTION 4

Use binomial theorem to expand:

a. $(1 + \sqrt{3}\ i)^{2011}$ 6mks

b. $(1 + \sqrt{3}\ i)^{-2011}$ 6mks

QUESTION 5

a. Show that $|\cos(z)|^2 = (\cos x)^2 + (\sinh y)^2$ for all $z \in \mathbb{C}$ where x = Re(z) and y = Im(z)

6mks

b. $|\sin z|^2 = (\sin x)^2 + (\sinh y)^2$ for all complex numbers z = x + yi 6mks

QUESTION 6

a. Compute $\cos(\frac{\pi}{3} + i)$ 6mks

b. Let $f(z) \begin{cases} \frac{\dot{z}3}{z2} & if\ z \neq 0 \\ 0 & if\ z = 0 \end{cases}$ 6mks

Show that f(z) is actually nowhere differentiable i.e. the complex derivative f;(z) does not exist for any $Z \in C$