Click to download more NOUN PQ from NounGeeks.com
A-PDF Watermark DEMO: Purchase from www.A-PDF.com to remove the watermark

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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2021_2 EXAMINATIONS

COURSE CODE: **PHY313**
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

a. Suppose that $z_1 = r_1(\cos\theta_1 + i\sin\theta_1)$ and $z_2 = r_2(\cos\theta_2 + i\sin\theta_2)$

show that $\frac{z_1}{z_2} = \frac{r_1}{r_2}\left[\cos(\theta_1 - \theta_2) + i\sin(\theta_1 - \theta_2)\right]$ **7 Marks**

b. Evaluate $\int_c \frac{z^2+1}{z^2 - z}dz$ where C is the circle $|z-1| = 1$ **6 Marks**

c. What is an analytical function? Can a function be differentiable at a point z_0 without being analytical at z_0 **3 marks**

d. Use Cauchy's integral formula to evaluate $\int_c \frac{2z+1}{z^2+z}dz$ **6 marks**

QUESTION 2

1. a. State two conditions for a function to be analytical **4 marks**

b. Show that: $\int_0^{\frac{\pi}{2}} e^{t+it}dt = \frac{1}{2}\left(e^{\frac{\pi}{2}} - 1\right) + \frac{i}{2}\left(e^{\frac{\pi}{2}} + 1\right)$ **8 marks**

Click to download more NOUN PQ from NounGeeks.com

QUESTION 3

a. Let $w = f(z) = z^2 + 3z$. Find the real part (u) and the imaginary part (v) if of w and calculate the value of f at $z = 1 + i3$. **5 Marks**

b. Verify that $u = x^2 - y^2 - y$ is harmonic in the whole complex plane and find a harmonic conjugate function v *of* u **7 Marks**

QUESTION 4

Express the following functions in polar form:

a. $f(z) = z^5 - 4z^2 - 6$ **6 marks**

b. State the Cauchy-Riemann equations **6 marks**

QUESTION 5

a. Use Cauchy's integral formula, evaluate $\int_c \frac{\cos \pi z^2}{(z-1)(z-2)} dz$ where c is |z|=3/2 **6 marks**

b. Explain the term residues and how can it be used for evaluating integrals **6 marks**

QUESTION 6

a. Given that $u(x,y) = e^{-x} cosy$, show that $u(x,y)$ is an harmonic function and find the function $v(x,y)$ that ensure that $f(z) = u(x,y) + iv(x,y)$ is analytic. **6 Marks**

b. Evaluate $\int_c \frac{z^2+1}{z^2-1} dz$ where c is the circle |z+1|=4 **6 marks**