



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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2021_1 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. What do you understand by a series? 3 mks
- b. Write the Cauchy integral formula. 2 mks
- c. Define the following:
 - i) Simple contour 2 mks
 - ii) Loop 2 mks
 - iii) Jordan curve Lemma 2 mks
- d. Explain the other test apart from the ratio test, which serves as a criterion for convergence 4 mks
- e. Mention three (3) rules that can be used for residue counting 3 mks
- f. What is an entire function 2 mks
- g. Explain a real valued function 2 mks

QUESTION 2

- a. If $x = \frac{z+\bar{z}}{2}$, $y = \frac{z-\bar{z}}{2}$
Express $f(z) = 4x^2 + i4y^2$ by a formula involving the variables z and \bar{z} 4 mks
- b. Define the following:
 - i. Laurent series 2 mks
 - ii Singularity 2 mks
 - iii Single pole 2 mks
 - iv Cauchy Residue 2 mks

QUESTION 3

- a. Show that if $f(z)$ satisfies the Cauchy – Riemann equation Z_0 , so does $\{f(Z_0)\}^n$ for every positive integer n 6 mks
- b. Show that the function $\sin(z)$ is nowhere analytic on \mathbb{C} 6 mks

QUESTION 4

- a. What is the inverse image of a point 3 mks
- b. Express $f(z) = z^5 + 4z^2 - 6$ in polar form 3 mks
- c. What do you understand by the sequence of complex number 3 mks
- d. The ratio test is used as a criterion for convergence. Discuss 3 mks

QUESTION 5

- a. Differentiate between the Domain and Range of a function 6 mks
- b. Write down how to find the domain of six (6) different functions 6 mks

QUESTION 6

Find the domain of the following:

$$f(x) = \frac{2x}{x^2-4} \quad 3 \text{ mks}$$

$$y = \sqrt{x-7} \quad 3 \text{ mks}$$

$$y = \ln(x-8) \quad 3 \text{ mks}$$

$$\text{Find the domain and range of the function } f(z) = X^2 + 2 \quad 3 \text{ mks}$$