



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: PHY306
COURSE TITLE: OPTICS II
CREDIT UNIT: 2
TIME ALLOWED: (2 HRS)

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

QUESTION 1

- (A) Explain the term: Simple Harmonic Motion (SHM) (3 marks)
- (B). Define amplitude of SHM (2 marks)
- (C). Explain the Phase of a vibrating particle (2 marks)
- (D). List two (2) conditions for interference of waves from two sources to occur. (2 marks)
- (E). Define interference of waves (3 marks)
- (F). Write three differences between the biprism and Lloyd's mirror fringes. (6 marks)
- (G). What are coherent waves? (2 marks)
- (H). Highlight the salient features of the resultant double slit diffraction pattern. (5 marks)

QUESTION 2

- (A). A ball rotates counter-clockwise in a circle of radius 3.00 m with a constant angular speed of 8.00 rad/s. At $t = 0$, its shadow has an x coordinate of 2.00 m and is moving to the right.
 - (i) Determine the position of the shadow as a function of time in SI units. (6 marks),
 - (ii) Find the shadow's velocity and acceleration at any time t (6 marks),
- (B). State the principle of superposition of waves (3 marks)

QUESTION 3

- (A). If the displacement of a moving particle measured in m at any time is given by $x = a \cos \omega t + b \sin \omega t$. Show that the motion is simple harmonic. (5 marks)

(B) If $a = 3$, $b = 4$, $\omega = 2$, find (i) the amplitude (3 marks), (ii) the period (3 marks), (iii) maximum velocity (2 marks), and (iv) maximum acceleration (2 marks).

QUESTION 4

Two electromagnetic waves with identical frequencies have individual intensities $I_1 = 4.00 \text{ W/m}^2$ and $I_2 = 2.00 \text{ W/m}^2$.

(A) What phase difference results in a maximum resultant intensity and what is that intensity? (5 marks)

(B) What phase difference results in minimum resultant intensity and what is that intensity? (5 marks)

(C) If we want a resultant wave with an intensity of $I = 7.00 \text{ W/m}^2$, what must the phase difference between I_1 and I_2 be? (5 marks)

QUESTION 5

(A). A viewing screen is separated from a double-slit source by 1.2 m. The distance between the two slits is 0.030 mm. The second-order bright fringe ($m = 2$) is 4.5 cm from the center line.

(i) Determine the wavelength of the light. (3 marks)

(ii) Calculate the distance between adjacent bright fringes. (5 marks)

(B). Red light ($\lambda = 664 \text{ nm}$ in vacuum) is used in Young's experiment with the slits separated by a distance $d = 1.20 \times 10^{-4} \text{ m}$. The screen is located at a distance of $L = 2.75 \text{ m}$ from the slits as seen in the figure below. Find the distance y on the screen between the central bright fringe and the third order bright fringe.

