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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2022_2 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, ω = 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 $I_1 = 4.00\ W/m^2$ and $I_2 = 2.00\ W/m^2$.

(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 $I = 7.00\ W/m^2$, 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 (λ = 664 nm in vacuum) is used in Young's experiment with the slits separated by a distance $d = 1.20 \times 10^{-4}$ m. The screen is located at a distance of $L = 2.75$ 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.