NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PHYSICS
2025_2 EXAMINATIONS

COURSE CODE: **PHY306**
COURSE TITLE: **OPTICS II**
CREDIT UNIT: **3**
TIME ALLOWED: **(3 HRS)**
INSTRUCTION: ***Answer question 1 and any other two questions***

QUESTION 1

(A). Define amplitude of SHM **(2 marks)**

(B). Explain the Phase of a vibrating particle **(3 marks)**

(C) Show, by the principle of superposition that their resultant displacement is simple harmonic and of amplitude A of harmonic waves: $\boldsymbol{y_1 = a_1 \sin \omega t}$ and $\boldsymbol{y_2 = a_2 \sin(\omega t + \delta)}$of same frequency but having constant phase difference, δ, where $\boldsymbol{a_1}$and $\boldsymbol{a_2}$are two different amplitudes, and ω is the common angular frequency of the two waves. **6 marks**

(D). List two (2) conditions for interference of waves from two sources to occur. **3 marks**

(E) State the three principal types of measurement that can be made with Michelsoninterferometer **4 marks**

(F) A thin film of $5 \times 10^5 cm$thickness is illuminated by white light normal to its surface ($r = 0^o$). Its refractive index is 1.5. Of what colour will the thin film appear in reflected light? **6 marks**

(G). Highlight any three salient features of the resultant double slit diffraction pattern. **6 marks**

QUESTION 2

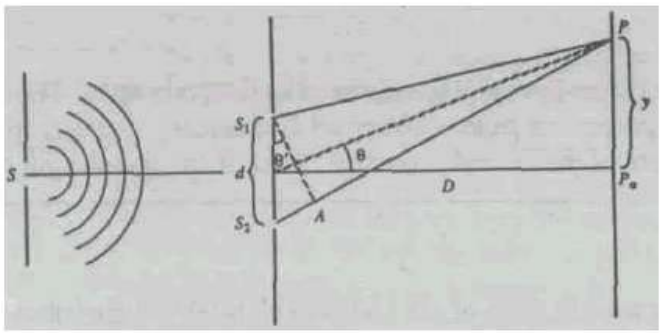
(A) State superposition principle of wave **4 marks**

(B) Using the geometry diagram of Young's experimentof in figure 1 below. Show that the path difference;

(i) $\frac{yd}{D} = m\lambda$, for bright fringes

(ii) $\frac{yd}{D} = \left(m + \frac{1}{2}\right)\lambda$, for dark fringes

where, (m= 0, 1, 2, 3 …….)



Assumed the waves start out at the same phase as slit S_1 and S_2 are equidistant from$S$. **9 marks**

(C) Monochromatic light passes through two narrow slits $0.20\ mm$ apart. The third-order bright fringe of the interference pattern, observed on a screen 100 mm from the slits, is $1.6\ mm$ from the Centre of the central maximum. What is the wavelength of the light? **7 marks**

QUESTION 3

(A) State the two differences in the reflected and transmitted systems of rings **3marks**

(B) Briefly explain with the aids of relevant diagrams, fringes of equal inclination. **8 marks**

(C) White light is reflected normally from a uniform oil film ($\mu = 1.33$). Aninterference maximum for 6000 Å and a minimum for 4500 Å, with no minimum in between, are observed. Calculate the thickness of the film.

9 marks

QUESTION 4

(A) Differentiate between Michelson interferometer and Fabry-perot interferometer and give one application of each **8 marks**

(B) Highlight the kind of fringes obtained when mirror 1 (M_1) and mirror 2 (M_2) of Michelson's interferometer are; (i) parallel to each other and (ii) not parallel to each other **4 marks**

(C) When the movable mirror of Michelson's interferometer is shifted through 0.0889 mm, a shift of 300 fringes is observed. What is the wavelength of light used? Give the answer in Angstrom units. **8 marks**

QUESTION 5

(A) (i) List and differentiate between the two classes of diffraction **4 marks**

(ii). Calculate the minimum thickness of a soap-bubble film (n = 1.33) that results in constructive interference in the reflected light if the film is illuminated with light whose wavelength in free space is λ = 600 nm. **6 marks**

(B) Define the resolving power of a diffraction grating **3 marks**

(C) Monochromatic light from a helium-neon laser (λ = 632.8 nm) is incident normally on a diffraction grating containing 6 000 lines per centimeter. Find the angles at which the first-order and second-order maxima are observed. **7 marks**