



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

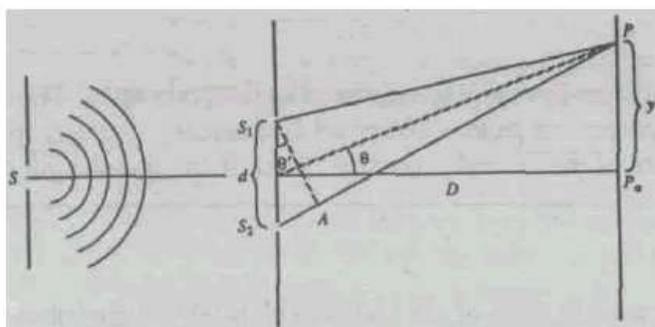
COURSE CODE: PHY306
COURSE TITLE: OPTICS II
CREDIT UNIT: 3
TIME ALLOWED: (3 HRS)
INSTRUCTION: Answer question 1 and any other two questions

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: $y_1 = a_1 \sin \omega t$ and $y_2 = a_2 \sin (\omega t + \delta)$ of same frequency but having constant phase difference, δ , where a_1 and 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 Michelson interferometer **4 marks**
- (F) A thin film of $5 \times 10^5 \text{ cm}$ thickness is illuminated by white light normal to its surface ($r = 0^\circ$). 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 experiment of 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, ($m = 0, 1, 2, 3 \dots\dots$)



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 **3 marks**
- (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 ($\mu = 1.33$). An interference maximum for 6000 \AA and a minimum for 4500 \AA , 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 $\lambda = 600 \text{ nm}$. **6 marks**
- (B) Define the resolving power of a diffraction grating **3 marks**
- (C) Monochromatic light from a helium-neon laser ($\lambda = 632.8 \text{ nm}$) 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**