



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

DEPARTMENT OF PHYSICS

2024 1 EXAMINATION

COURSE CODE: PHY 406
COURSE TITLE: OPTICS III
CREDIT UNIT: 3
TIME ALLOWED: (3 HRS)

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

QUESTION 1

- ai. Briefly discuss transverse spatial coherence [4 marks]
- ii. What is the relationship between temporal coherence and length of wave train? [4 marks]
- bi. When does light emission take place in an atom? And write the expression of the frequency of the emitted radiation. [5 marks]
- ii. What are necessary attribute that must be recorded to obtain the hologram? [4 marks]
- ci. Describe, in its simplest form, an optic fibre, and also explain step-index fibre. [4 marks]
- ii. Illustrate the variation of the refractive index with the radius of a step-index fibre. [4 marks]

(Total = 25 marks)

QUESTION 2

- a. If light of 660 nm wavelength has a wavetrain $\lambda/20$ long, what is its (i) coherence length and (ii) coherence time. [10 marks]
- b. Discuss Monochromaticity [5 marks]

(Total = 15 marks)

QUESTION 3

- a. Describe the mechanism that will ensure the spatial coherence of the laser beam. Use of diagram necessary. [10 marks]

b. Explain the monochromaticity of the laser light.

[5 marks]

(Total = 15 marks)

QUESTION 4

a. Highlight six (5) main applications of lasers.

[10 marks]

b. State the difference between normal photography and holography

[5 marks]

(Total = 15 marks)

QUESTION 5

a. Why is light not used for communication purposes despite the advantages.

[6 marks]

bi. State the need for fibres to carry optical signals.

[5 marks]

ii. What are the additional characteristics the optical fibre must have to serve as an effective optical signal-carrying medium.

[4 marks]

(Total = 15 marks)

QUESTION 6

ai. What will happen if time delay is much less than the coherent time in the Michelson interferometer?

[4 marks]

ii. Explain monochromaticity

[4 marks]

bi. Given $I_{max} = \sin^{-1}(n_1^2 - n_2^2)^{1/2}$, what does I_{max} and $(n_1^2 - n_2^2)^{1/2}$ stands for?

[4 marks]

ii. State the reason for referring to optical fibres as optical waveguide

[3 marks]

(Total = 15 marks)