



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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2021_2 EXAMINATIONS

COURSE CODE: PHY406
COURSE TITLE: OPTICS III
CREDIT UNIT: 3
TIME ALLOWED: (2½ HRS)

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

QUESTION 1

- (A). What is coherence time? (2 marks)
- (B). What is coherence length? (2 marks)
- (C). A reflection hologram is made with red laser light. However, when illuminated with white light, the image appears yellow, or even green. Why? (3 marks)
- (D). Define (i) areana and (ii) visibility (4 marks)
- (E). Mention three processes by which an atom can move from one state (e.g. ground state) to the other (e.g. excited state) (3 marks)
- (F). Mention the three pre-requisite requirements for laser operation (3 marks)
- (G). List five areas of laser application (5 marks)

QUESTION 2

Write short notes on any three (3) most commonly used ways of pumping a laser and achieving the population inversion necessary for stimulated emission to occur (4 marks each)

QUESTION 3

- (a). Mention four (4) most commonly used ways of pumping a laser and achieving the population inversion necessary for stimulated emission to occur. (4 marks)
- (b). If laser action occurs by the transition from an excited state to the ground state and it produces light of 693nm wavelength, what is the energy of the excited state? (Take the energy of the ground state to be zero, $c = 3 \times 10^8$ m/s, $h = 6.6 \times 10^{-34}$ Js). (8 marks)

QUESTION 4

- (a). Write a brief description of liquid lasers **(8 marks)**
- (b). If in an interference fringe pattern, the maxima receive 20 units of light while the minima receive 7, compute the percentage visibility of the interference fringe **(4 marks)**

QUESTION 5

- (a). If we tried to visualize sound or light waves from a point source in space, what would an instantaneous pattern be? **(2 marks)**
- (b). Differentiate between the process of holography and that of ordinary photography. **(6 marks)**
- (c). Discuss some of the salient features of a hologram **(4 marks)**

QUESTION 6

- (a). 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 $\lambda = 600 \text{ nm}$ **(5 marks)**
- (b). What are the two types of pumping schemes in laser application? **(2 marks)**
- (c). Briefly discuss solid state lasers. **(5 marks)**