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

DEPARTMENT OF PURE AND APPLIED SCIENCE

2021_1 EXAMINATIONS

COURSE CODE:	**PHY 406**
COURSE TITLE:	**OPTICS III**
CREDIT UNIT:	**3**
TIME ALLOWED:	**(2½ HRS)**
INSTRUCTION:	***Answer question 1 and any other four questions***

QUESTION 1

(A). What are the properties of coherence of light sources? **(2 marks)**

(B). List four primary properties of laser light that make it useful in technological applications **(4 marks)**

(C). Explain the term: coherence **(2 marks)**

(D). Why is there no definite phase relationship between light waves from two ordinary light **(3 marks)**

(E). Define width of spectral line. **(2 marks)**

(F). Explain what is meant by temporal coherence **(3 marks)**

(G). The output of a laser has pulse duration of 20 ms and average output power of 1.75 W per pulse. How much energy is released per pulse if the wavelength is 5890 Å? **(4 marks)**

(H). How is the energy released by an atom undergoing a non-radioactive transition? **(2 marks)**

QUESTION 2

Let E_1 and E_2 be the electric fields associated with the light waves emanating from two coherent sources slits $S_1$and S_2. These waves superpose and the combined electric field at any point on the screen is given by $E = E_1 + E_2$ and the corresponding resultant intensity I given to be $I_1 + I_2 + 2\langle E_1 E_2 \rangle$. Discuss the nature of the resultant intensity I when:

(i) $E_1 = E_2$ **(6 marks)** and **(ii)** $E_1 = -E_2$? **(6 marks)**

QUESTION 3

(a). Differentiate between Temporal Coherence and Spatial Coherence. **(4 marks)**

(b). Calculate (i) coherence length and (ii) coherence time for light of 20λ long wave-train and 660 nm wavelength **(8 marks)**

QUESTION 4

(a). Explain relative phase of two coherent waves **(4 marks)**

(b). 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 is 4.5 cm from the center line.

(i) Determine the wavelength of the light, (ii) Calculate the distance between adjacent bright fringes. **(8 marks)**

QUESTION 5

(a). Under what conditions will (i) constructive interference and (ii) destructive interference occur on Young's double slit experiment? **(4 marks)**

(b). Assume the sodium line at wavelength 6310 Å, produced in a low-pressure discharge with a spread in wavelength of 0.0175 Å. What should be (i) the coherence length and (ii) line width in hertz, given the velocity of light to be 3×10^8 m/s. **(8 marks)**

QUESTION 6

(a). Why is it necessary to have coherent sources to be able to observe interference fringes? **(2 marks)**

(b). If we tried to visualize sound or light waves from a point source in space, what would an instantaneous pattern be? **(2 marks)**

(c). Laser light from a 7 mW source of aperture diameter 1.5 cm and wavelength 5000 Å is focused by a lens of focal length 10 cm. Find the intensity of the image. **(8 marks)**