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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS**

**SEPTEMBER/OCTOBER 2015 EXAMINATION**

**SCHOOL OF SCIENCE AND TECHNOLOGY**

**COURSE CODE: PHY406**

**COURSE TITLE: OPTICS III**

**TIME: 3 Hours**

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

1. (a) (i ) Explain the term “coherence” as applied to sources of waves **2 marks**

(ii)If light of 660 nm wavelength has a wavetrain long, what are its coherence length and coherence time? **5 marks**

(b)(i) What do you understand by the term *areana* **2 marks**

(ii) If the visibility in an interference fringe pattern is 50 percent and the maxima receive 15 units of light, how much light do the minima receive? **5 marks**

2.(a)(i)Briefly explain the concept of stimulated emission **5 marks**

(ii) Name four types of laser **2 marks**

(b)(i) The absolute temperature, , for an ordinary source of light is typically of the order of K. Show that in such sources, the process of spontaneous emission will dominate over the stimulated emission. **5 marks**

(ii) Mention four ways of pumping a laser and achieving the population inversion necessary for stimulated emission to occur **2 marks**

3.(a)(i) What is holography? **3 marks**

(ii) Briefly explain the process of image formation by holography **5 marks**

(b) (i)Mention four applications of holography **2 marks**

(ii) If the angle subtended at the hologram by the signal and the reference beam is 15°, what is the spacing of the fringes provided the wavelength is 492 nm? **4 marks**

4.(a)(i) What is an optical fibre ? **3 marks**

(ii) Briefly describe two types of optical opticalfibre**4 marks**

(b)(i) What will happen if the refractive index of the cladding material is higher than that of the core in an optical fibre? **2 marks**

(ii) If the core and cladding refractive indices for a step-index fibre is 1.47 and 1.46 respectively, what will be the broadening of a pulse after a distance of 5 km? **5 marks**

5.(a)(i) Suppose you have two optical fibres*A* and *B.* The refractive indices of the core () and the cladding () materials is= 1.52, = 1.41, = 1.53, = 1.39. Which of the two fibres will have higher light gathering capacity? **5 marks**

(ii) A step-index fibrem in diameter has a core of refractive index 1.53 and a cladding of refractive index 1.39. Determine the numerical aperture for the fibre and the acceptance angle (or maximum entrance cone angle). **4 marks**

(b) Briefly discuss two applications of optical fibre **5 marks**

6.(a)(i) Briefly explain the origin of the width of the spectral lines. **4 marks**

(ii) If *d* is the distance through which one of the mirrors of Michelson interferometer has been moved obtain the equation for condition for disappearance of fringe pattern. **6 marks**

(b) From your equation in 6(a)(ii) which gives the path difference, in terms of two distinct wavelengths  and , for which fringes will disappear, show that  which is for all wavelengths lying between  and. **4 marks**

7. Write short notes on

(a) Optical pumping **4 ½ marks**

(b) Optical resonant cavity **4 ½ marks**

(c) Power loss in optical fibres **5 marks**