|  |
| --- |
| **King Saud University**  **College of Applied Medical Sciences**  **Optometry Department**  **OPTO-221: Second Mid-Term Exam** |

**QUESTION 1:**

List the main differences between the laser source and incandescent lamp source.

            Laser source                                  Incandescent lamp source

**Stimulated emission                |    Spontaneous emission**

**Coherent light                         |    Incoherent light**

**Monochromatic, and confined |    Multi-wavelnegths and**

**parallel Beam                          |    divergent beam**

**QUESTION 2:**

a) Why can laser be safely used for medical surgery?  **Because specific laser wavelength is being absorbed by a specific type of biological tissue.**

b) Describe briefly one example of medical application:  **In Glaucoma we have high fluid pressure which may destroy the optic nerve. Use a laser to open a tiny hole to retrieve a destructive pressure** .

**PROBLEM 1:**

Measurements are made of the intensity distribution in a Young’s interference pattern.  At a particular value of y (distance from the center of the screen), it is found that I/I0 = 82% when light of wavelength 5890 A is used.

a)     A)  What wavelength of light should be used in order to reduce the relative intensity at the same location to 55%?

b)     B)  What is the shift (variation) in minimum phase differences in radians between sources accompanied with this change in wavelengths?

c)       What is the new deviation angle θ attributed to the new wavelength?

**Solution:**

**Data:                                       Requests:**

**Iav/Io = 0.82                           l2=  ? (if new Iav/Io = 0.55) at same y**

**l1=  5890 A°                           DF = F(l2) - F(l1) = ?**

**q (l2) = ?**

**---------------------------------------------------------------------------------**

**a)-  Same location y, also same  |πδ/l2= cos-1(0.742) = 42.1°**

**Path difference δ, for both          |           l2= 351.1 nm**

**equations.                                   |**

**-------------------------------------**

**Iav/Io = cos2 (πδ/l2) = 0.55      |           b)- DF = F(l2) - F(l1) = ?**

**We need so to get δ, from           |           F(l1)/2=  πδ/l1----- F(l1)=Iav/Io = 0.82                               |          50.2°**

**0.82 =  cos2 (πδ/l1)                   | F(l2)/2=  πδ/l2----- F(l2)= 84.2°**

**cos (πδ/l1) = Ö0.82 = 0.91        |**

**πδ/l1= cos-1 (0.91) = 25.1 °    |           DF = 84.2° - 50.2° = 34°**

**δ = 25.1 °x l1    = 82.13 nm**

**180°**

**cos (πδ/l2) = Ö0.55**

**------------------------------------------------------------------------------------**

**PROBLEM 2:**

A soap bubble of index of refraction 1.33 reflects both red and green colors in white light.  What minimum thickness of soap bubble will allow this to happen? (In air,λred =700 nm, λgreen=500 nm.)

**Solution:**         **n=1.33                        tmin= ?**

**lr=700 nm**

**lg=500 nm**

**The system is air /layer/air ------ low index/high index/ low index ---so we use formula of constructive interference**

**2t=(m + ½)/l/n**

**For Red                                  |                       For Green**

**t=(m + ½)/l/2n                                         |                       t=(m + ½)/l/2n**

**m=0  t= 131.6 nm                        |     m=0    t= 94 nm**

**m=1   t= 394.7 nm                                      |      m=1    t= 282 nm**

**m=2   t= 657.2 nm                        |    m=2    t= 470 nm**

**|    m=3    t= 658 nm**

**So min thikness which allow both colors is**

**t= 657.2 nm**