B.Sc. (With Credits)-Regular-Semester 2012 Sem III

B.Sc.23122 - Physics Paper - II (Optics And Laser)

P. Pages : 3 **GUG/W/16/3349**

Time : Three Hours * 4 2 8 8 * Max. Marks : 50

Notes : 1. All questions are compulsory.
2. Draw well labelled diagram wherever necessary.

Either

1. a) i) Explain the experimental arrangement to obtain Newton's rings by reflected light. **3**

ii) Show that the diameters of dark rings is directly proportional to the square root of natural number. **3**

iii) How will you determine the refractive index of transparent liquid by using Newton's rings method. **2**

iv) Newton's rings are formed by reflected light and the diameter of sixth dark ring is observed to be 1.15 cm. When a liquid is introduced in the space between the lens and the plate, the diameter of the ring becomes 1 cm. Find the refractive index of liquid. **2**

OR

b) i) What is zone plate ? Obtain an expression for the area of zones. **5**

ii) Compare the zone plate with a convex lens. **3**

iii) A zone plate has the radius of the first ring equal to 0.05 cm. If the light of wavelength 5000 A^o fall on the plate, where should the screen be placed so that the light is focused to a bright spot ? **2**

Either

2. a) i) Explain construction and working of Nicol Prism to obtain the polarized light. **6**

ii) Explain Nicol prism is used as an analyser. **2**

iii) Calculate the least thickness quarter wave plate for wavelength 6000 A^o if the refractive indices for ordinary and extraordinary rays are 1.544 and 1.553 respectively. **2**

OR

b) i) Explain the principle, construction and working of a Ruby laser. **6**

ii) What is the difference between spatial and temporal coherence. **2**

iii) For a red cadmium line of wavelength 6438 A^o and the coherence length 35 cm. Find coherence time. (Given $C = 3 \times 10^8$ m/sec) **2**

Either

3. a) Derive the conditions of interference for bright and dark fringes due to reflected light from thin film. **2½**

b) How will you use the Michelson interferometer for the measurement of wavelength of monochromatic light. **2½**

c) The light is incident on a glass plate of refractive index 1.53 at the polarizing angle. Calculate the angle of refraction of the light. **2½**

d) Explain briefly a semiconductor laser. **2½**

OR

e) Two narrow and parallel slits 0.2 cm apart are illuminated by monochromatic light of wavelength 589.3 nm. The interference pattern is observed at a distance of 50 cm from the slits. Calculate the fringe width. **2½**

f) Explain the Rayleigh's criterion for resolution with neat diagram. **2½**

g) State and prove Brewster's law. **2½**

h) Explain the applications of laser. **2½**

Either

4. a) Derive the expression for fringe width of interference fringes in wedge shaped film. **2½**

b) Calculate the minimum number of lines in grating which will just resolve the lines of the wave lengths 5890 A^o and 5896 A^o in the second order. **2½**

c) Distinguish between the positive and negative crystal. **2½**

d) Explain spontaneous and stimulated emission. **2½**

OR

e) Derive the expression for path difference between the rays of light transmitted from the thin film. **2½**

f) What is diffraction ? State the difference between interference and diffraction. **2½**

g) Derive the expression for thickness of quarter wave plate. **2½**

h) Find the coherent length for white light, the wavelength of white light ranges from 400 nm to 700 nm. **2½**

5. Attempt **any ten** of the following.

a) What are coherent sources ? **1**

b) What are localized fringes ? **1**

c) State the principle of superposition of light waves. **1**

d) What is interferometer ? **1**

e) What is mean by resolving power of optical instrument. **1**

f) Define grating element of plane transmission grating. **1**

g) Define polarisation of light. **1**

h) What is phase retardation plate ? **1**

i) Define optic axis. **1**

j) What is mean by population inversion ? **1**

k) What is meant by coherence time ? **1**

l) State characteristic of laser. **1**

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