Bachelor of Science (B.Sc.) Third Semester

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

P. Pages : 3 **GUG/W/18/1275**

Time : Three Hours * 0 9 8 * Max. Marks : 50

Notes : 1. All questions are compulsory.
2. Draw neat labelled diagrams, wherever necessary.

1. Either:

a) i) Explain the experimental arrangement to obtain Newton's Rings. Show that the diameters of bright rings is directly proportional to the square roots of odd natural numbers. **6**

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

iii) In Newton's rings experiment the diameter of the 4^{th} and 12^{th} rings are 0.4cm and 0.7cm respectively. Find the diameter of the 20^{th} dark ring. **2**

OR

b) i) State the difference between Fresnel and Fraunhoffer type diffraction. **2**

ii) In Fraunhoffer diffraction, discuss the diffraction pattern obtained due to single slit and derive an expression for width of the central maximum on the screen. **6**

iii) In an arrangement for Fraunhoffer diffraction we use a slit of width 0.2mm and first minimum is at 5mm on either side of central maximum. If the distance between the lens and the screen is 2m, Calculate the wavelength of light used. **2**

2. Either:

a) i) Explain the construction and working of Nicol Prism. **6**

ii) Explain the working of a half wave plate. **2**

iii) Calculate the thickness of a half wave plate for light of wavelength **2**
$\lambda = 5000A^{o}$, $\mu_o = 1{\cdot}544$, $\mu_e = 1{\cdot}533$.

OR

b) i) Explain Absorption, Spontaneous emission and stimulated emission. **3**

ii) Explain principle, construction and working of Ruby laser with energy diagram. **7**

3. Either:

a) State the condition for obtaining steady interference pattern. **2½**

b) A single slit of width 1mm is illuminated by light of wavelength 589nm. Find the angular spread of the central maximum of diffraction pattern observed. **2½**

c) How Nicol Prism used as analyzer of plane polarized light? **2½**

d) Explain semiconductor laser. **2½**

OR

e) Explain interference in wedge-shaped films. **2½**

f) Derive an expression for resolving power of grating. **2½**

g) Calculate the thickness of quarter wave plate for light of wavelength 5893Aº, given refractive indices for ordinary and extraordinary ray are 1.544 and 1.553 respectively. **2½**

h) Explain spatial and temporal coherence. **2½**

4. Either:

a) Newton's rings are observed in reflected light of wavelength $5.9\times10^{-7}\,\text{m}$. The diameter of 10^{th} dark ring is 0.5cm. Find the radium of curvature of the lens and thickness of the air film. **2½**

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

c) Derive an expression for thickness of quarter wave plate. **2½**

d) Explain the characteristics of laser beam. **2½**

OR

e) Explain the interference of light in thin film observed due to transmitted ray of light. **2½**

f) Explain Half Period Zones and zone plates. **2½**

g) Determine the wavelength of light used when a quarter wave plate of thickness $1\cdot2\times10^{-3}\,\text{cm}$ is used for detection. Given $\mu_e = 1\cdot65$ and $\mu_o = 1\cdot64$. **2½**

h) Write the applications of lasers. **2½**

5. Solve **any ten** of the followings.

a) What is interference of light. **1**

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

c) What are localised fringes. **1**

d) What is the used of compensating glass plate used in a Michelson interferometer. **1**

e) Distinguish between interference and diffraction. **1**

f) Define grating element. **1**

g) State Brewester law. **1**

h) Define optic axis of crystal. **1**

i) Give one example of positive and negative uniaxial crystal. **1**

j) Define population inversion. **1**

k) Define optical pumping. **1**

l) What is metastable state. **1**

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