BRAINWARE UNIVERSITY

Term End Examination 2023
Programme – B.Optometry-2022
Course Name – Physical Optics
Course Code - BOPTOC204
(Semester II)

Full Marks : 60
Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question)
1 x 15=15

1. *Choose the correct alternative from the following :*

(i) Write the name of the phenomena for which the white light is separated into its component colours.
   a) Dispersion   b) Refraction
   c) Reflection   d) Radiation

(ii) Tyndall effect is the scattering of the light by
   a) air particles   b) solid particles
   c) liquid particles   d) colloidal particles

(iii) If light is incident at the angle of polarization then select the angle between the reflected ray and refracted ray is
   a) $\pi/4$ b) $\pi/2$
   c) π d) $3\pi/2$

(iv) Lux can be written as
   a) $lumen\ m^{-2}$ b) $lumen\ m^{-1}$
   c) $lumen\ m$ d) $lumen\ m^{-3}$

(v) The ratio of Einstein's A and B coefficient is proportional to
   a) υ b) υ^2
   c) υ^3 d) $1/\upsilon$

(vi) Select the phenomena of light responsible for the working of the human eye
   a) Reflection   b) Refraction
   c) Power of accommodation   d) Persistence of vision

(vii) If the absorption of electromagnetic radiation by matter results in the emission of radiation of the same or longer wavelengths for a short time, the phenomenon is

termed as which of the following?

a) Luminescence
b) Fluorescence
c) Phosphorescence
d) Spontaneous emission

(viii) Select the correct option for the orientation of the E and B fields in electromagnetic waves rays

a) they are parallel to the waves direction of travel, as well as to each other
b) they are parallel to the waves direction of travel, and perpendicular to each other
c) they perpendicular to the waves direction of travel, and parallel to each other
d) they are perpendicular to the waves direction of travel, and also to each other

(ix) A double slit interference experiment is carried out in air and the entire arrangement is dipped in water. The fringe width

a) increases
b) decreases
c) remains unchanged
d) fringe pattern disappears

(x) The fringe width of interference pattern of Young's double slit experiment is (2d is the distance between the two coherent sources)

a) $D\lambda/d$
b) $2d/D\lambda$
c) $D\lambda/2d$
d) $D/\lambda d$

(xi) The resolving power of a grating having N number of total rulings in nth order is expressed by

a) n/N
b) nN
c) N/n
d) none of these

(xii) In a ruby laser, name the pumping process to achieve population inversion

a) Optical pumping
b) Inelastic atom-atom collision
c) Chemical reaction
d) Applying strong electric field

(xiii) Two sources will be coherent if they have

a) constant wavelength
b) constant phase difference
c) constant amplitude
d) none of these

(xiv) The population of electron in different energy states of a system in the thermal equilibrium is governed by

a) Bragg's law
b) Stefan's law
c) Boltzmann distribution law
d) Wien's displacement law

(xv) The illumination is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. Above statement is associated with

a) Planck's law
b) Macbeth's law of illumination
c) Bunsen's law of illumination
d) Lambert's cosine law

Group-B
(Short Answer Type Questions)   3 x 5=15

2. Show that the energy is conserved in interference.   (3)

3. Compute the missing orders for a double-slit Fraunhofer diffraction pattern if the slit widths are 0.16 mm and they are 0.8 mm apart.   (3)

4. Explain population inversion in lasing action.   (3)

5. Sate the S.I unit of luminous flux. Define lumen. (3)

6. Calculate the frequency range of visible light, given that it encompasses wavelengths from 380 nm to 760 nm. (3)

OR

Distinguish between scattering and dispersion of light. (3)

Group-C
(Long Answer Type Questions) 5 x 6=30

7. State and explain the inverse square law as applied in photometry. (5)

8. Classify different types of scattering of light. (5)

9. Discuss the Nicol prism working as a polarizer. (5)

10. Express the relationship between Einstein's A and B coefficients. (5)

11. In a He- Ne laser transition from E_3 to E_2 level gives a laser emission of wavelength 632.8 nm. If the energy of the E_2 level is 15.2×10^{-19} J, Calculate the required pumping energy, if there is no energy loss in HE- NE laser. (5)

12. Newton's rings are formed by light reflected normally from a plano-convex lens and a plane glass plate with a liquid between them. The diameter of nth and (n+10)th bright rings are 2.18 mm and 4.51 mm respectively. Calculate the refractive index of the liquid. Radius of curvature of the lens is 90 cm and wavelength of light employed is 589.3 nm. (5)

OR

Deduce the expression for the resolving power of a telescope. (5)

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