

2022

ELECTRONICS — HONOURS

Paper : CC-14

(Photonics)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer **question no. 1** and **any four** questions from the rest.

1. Answer **any ten** questions :

1×10

- (a) Phenomenon of interference is based on
- (i) conservation of momentum
 - (ii) conservation of energy
 - (iii) conservation of momentum and energy
 - (iv) quantum nature of light.
- (b) When two light wave of same amplitude add constructively, the intensity of light becomes
- (i) double
 - (ii) half
 - (iii) four times
 - (iv) one-fourth.
- (c) In Young's experiment, when the distance between slit and screen is doubled, while separation of slit is halved, then fringe width will be :
- (i) 4 times
 - (ii) $\frac{1}{4}$
 - (iii) doubled
 - (iv) unchanged.
- (d) A linearly polarized wave is always
- (i) in x-y plane
 - (ii) A transverse wave
 - (iii) A longitudinal wave
 - (iv) in y-z plane.
- (e) If phase difference between two rays is $\pi/2$ and angle of incidence is equal to $\pi/4$. The emergent light is
- (i) linearly polarized
 - (ii) circularly polarized
 - (iii) elliptically polarized
 - (iv) non-polarized.

Please Turn Over

- (f) The principle of LASER action involves
- stimulated emission
 - population inversion
 - amplification of a particular frequency emitted by the system
 - All of the above.
- (g) Which of the following laws can be explained by Huygen's principle?
- Diffraction
 - Reflection
 - Refraction
 - All of these.
- (h) The difference of refractive index of core and cladding is very small. The acceptance angle of optical fibre is
- large
 - medium
 - small
 - zero.
- (i) The reverse current of a photo diode is modulated by
- changing reverse bias
 - changing illumination
 - Both (i) and (ii)
 - None of (i) and (ii).
- (j) A device that reduces the intensity of light in fibre optic communication system is
- reducer
 - var meter
 - optical attenuator
 - compressor.
- (k) Essential for LED :
- Direct band gap semiconductor
 - Compound semiconductor
- None
 - Both 1 and 2
 - 1 only
 - 2 only.
- (l) Which of the following liquid crystal layer is used in LCD?
- Heavy water
 - Nematic
 - Hydrosulphuric acid
 - Hydrochloric acid.
2. (a) What do you mean by reflection coefficient and transmission coefficient?
 (b) State Brewster's law. Explain the concept of refractive index.
 (c) What is dispersion? (2+2)+(2+2)+2
3. (a) What is anti-reflecting film? Explain with suitable diagram.
 (b) Write down the differences between interference and diffraction.
 (c) A width of a certain interference pattern is bandwidth (β) = 0.002 cm. What is the distance of 5th dark fringe from center? 4+3+3

4. (a) Write down the differences between Fresnel's and Fraunhofer's diffraction.
(b) What is a Diffraction Grating? What are the advantages of using a Diffraction Grating over prism?
(c) What is the resolving power of an optical instrument? 3+(2+2)+3
5. (a) Differentiate between spontaneous emission and stimulated emission.
(b) Explain the working principle of a basic two-level Laser system with suitable diagram.
(c) What is the threshold condition for Laser Oscillation? 3+5+2
6. (a) What are the advantages and disadvantages of LCD over LED?
(b) Write the advantages of photo transistor and p-i-n photo diode.
(c) Which materials are used in manufacturing of LEDs?
(d) What are the internal and external quantum efficiencies of a LED? 3+3+2+2
7. Write short notes on the following :
(a) Bolometer
(b) Photo transistor
(c) Photomultiplier tube. 3+3+4
8. (a) Derive the expression of numerical aperture of optical fibre.
(b) In a step index fibre, core index $n_1 = 1.45$ and cladding index $n_2 = 1.41$. Find numerical aperture and full acceptance angle.
(c) Write the major causes of light losses in a fibre. 4+(2+2)+2
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