2025

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*** from the rest.

1. Choose the correct alternative (***any ten***) : 1×10

(a) Which of the following laws can be explained by Huygen's principle?

(i) Diffraction (ii) Reflection

(iii) Refraction (iv) All of these.

(b) The impedance of free space is

(i) $Z = \sqrt{\frac{\mu_0}{\varepsilon_0}}$ (ii) $Z = \sqrt{\mu_0 \varepsilon_0}$

(iii) $Z = \sqrt{\frac{1}{\mu_0 \varepsilon_0}}$ (iv) $Z = \sqrt{\frac{\varepsilon_0}{\mu_0}}$.

(c) A suitable device for low level optical signal is

(i) avalanche photodiode (ii) p-i-n photodiode

(iii) solar cell (iv) photo transistor.

(d) The thin film interference depends on the

(i) amplitudes of the reflected waves

(ii) frequencies of the reflected waves

(iii) phase difference between the reflected waves

(iv) none of the above.

(e) The optical fibre with the best performance is

(i) single mode step index fibre (ii) multimode step index fibre

(iii) multimode graded index fibre (iv) both (ii) and (iii).

4. (a) Write down the differences between a plane wave and a spherical wave.
   (b) State Brewster's law.
   (c) What do you mean by polarization of light?
   (d) What are the three types of polarization?
   (e) What is dispersion? 2+2+2+2+2

5. (a) State and explain Malus law.
   (b) Give one example of positive and negative uniaxial crystal.
   (c) What is the importance of Faraday's rotation?
   (d) Explain the phenomena of polarization by selective absorption. 4+2+2+2

6. (a) Why GaAs is used for the making of LED instead of Si and Ge?
   (b) Give two examples of compound semiconductors used for making red LED.
   (c) Draw a neat diagram of an LED driver circuit and explain its working principle.
   (d) What is a photomultiplier tube? 2+2+(1+3)+2

7. (a) Write the names of common types of LCD panels.
   (b) Explain how LCD display works.
   (c) What is Twisted Nematic display?
   (d) What are the advantages of LCD display over LED display? 2+3+3+2

8. (a) What is acceptance angle in an optical fibre?
   (b) How does light travel through an optical fibre? Explain with diagram.
   (c) What are single mode and multimode fibres?
   (d) Differentiate between step index and graded index fibre. 2+3+2+3

(f) The electric field of a light wave consists of two perpendicular linear components having the same amplitude and a phase difference of 90°. The light is

(i) linearly polarized (ii) circularly polarized

(iii) elliptically polarized (iv) none of these.

(g) Which of the following is a characteristic of laser?

(i) Directionality (ii) Coherence

(iii) Monochromaticity (iv) all of these.

(h) The device which detects the power of incident EM wave is

(i) Bolometer (ii) Photomultiplier

(iii) Photo transistor (iv) p-i-n diode.

(i) What is the typical range of forward voltage of LED?

(i) 5–12 V (ii) 1.7–3.3 V

(iii) 5–12 mV (iv) 1.7–3.3 mV.

(j) Which one of the following LASER has highest efficiency?

(i) He-Ne (ii) CO_2

(iii) Ruby (iv) Semiconductor.

(k) In an optical fibre, the refractive index n_1 of the core and the refractive index n_2 of the cladding are related to each other as

(i) $n_1 = n_2$ (ii) $n_1 > n_2$

(iii) $n_1 < n_2$ (iv) no relation between n_1 and n_2.

(l) The diode which can be used as a photodetector in fibre optic communication system is

(i) semiconductor LASER diode (ii) LED

(iii) PIN photodiode (iv) Zener diode.

2. (a) What are constructive and destructive interferences? Explain with suitable diagrams.

(b) Describe Young's double slit experiment. Derive the expression for fringe width. (2+2)+(3+3)

3. (a) Explain diffraction of light.

(b) What is a diffraction grating? Explain with suitable diagram.

(c) For the diffraction grating, derive (i) the expression for the resultant amplitude of a single diffracted wave, (ii) the condition for principal maxima. 2+2+(4+2)