

OPTO ELECTRONICS & FIBER OPTICS
(AEI3131)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

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

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) In a solar cell, the main conversion of energy takes place from:
(a) Thermal to electrical (b) Optical to electrical
(c) Mechanical to electrical (d) Chemical to electrical
- (ii) Which effect forms the basis of photodiodes?
(a) Photovoltaic effect (b) Photoemissive effect
(c) Electroluminescence (d) Thermionic emission
- (iii) Dye-Sensitized Solar Cells (DSSC) mainly use:
(a) Organic dyes (b) Inorganic semiconductors
(c) Metallic cathodes (d) Both (a) and (b)
- (iv) The ratio of core refractive index to cladding refractive index is called:
(a) Numerical Aperture (b) Relative Index Difference
(c) Acceptance Angle (d) V-number
- (v) Which fiber sensor can be used for liquid level detection?
(a) Fabry-Perot sensor (b) Evanescent wave sensor
(c) Fiber Bragg grating (d) Polarimetric sensor
- (vi) Which material is commonly used for red LEDs?
(a) GaAsP (b) GaN (c) InGaN (d) Si
- (vii) A PIN photodiode includes:
(a) Heavily doped n and p region only
(b) An intrinsic layer between p and n regions
(c) Heterojunction with quantum well
(d) Avalanche multiplication region
- (viii) In a three-level laser system, pumping is required to achieve:
(a) Ground state depletion (b) Metastable state inversion
(c) Spontaneous emission (d) Blackbody radiation

- (ix) The heterojunction LED provides better efficiency because:
 (a) It has higher band gap
 (b) It reduces carrier recombination outside the active region
 (c) It uses transparent electrodes
 (d) It avoids avalanche breakdown
- (x) Which laser is a gas laser?
 (a) Ruby laser (b) Nd: YAG laser
 (c) CO₂ laser (d) Semiconductor laser

Fill in the blanks with the correct word

- (xi) A solar cell works on the principle of the _____ effect.
- (xii) Light travels inside an optical fiber by the principle of _____.
- (xiii) The efficiency of an LED is defined as the ratio of optical power emitted to _____ power supplied.
- (xiv) The quantum efficiency of a photodiode is the number of electron-hole pairs generated per incident _____.
- (xv) A laser can be used to measure velocity using the _____ effect.

Group - B

2. (a) Define phototransistor and its working. [[CO1](Analyse/HOCQ)]
 (b) Compare phototransistor with photodiode. [[CO1](Remember/LOCQ)]
 (c) Write industrial applications of phototransistors. [[CO1](Understand/IOCQ)]
3 + 4 + 5 = 12
3. (a) Define electroluminescence. [[CO1](Analyse/HOCQ)]
 (b) Explain its role in LED operation [[CO1](Remember/LOCQ)]
 (c) List applications of electroluminescent devices [[CO1](Understand/IOCQ)]
3 + 4 + 5 = 12

Group - C

4. (a) State the principle of light propagation in fibers. [[CO2](Remember/LOCQ)]
 (b) Explain types of optical fibers. [[CO2](Remember/LOCQ)]
 (c) Compare step-index and graded-index fibers. [[CO2](Evaluate/HOCQ)]
5 + 4 + 3 = 12
5. (a) Explain interferometric method for length measurement. [[CO4](Analyse/HOCQ)]
 (b) Write principle of Moiré fringes. [[CO4](Remember/LOCQ)]
 (c) Discuss birefringence and its applications. [[CO4](Understand/IOCQ)]
5 + 4 + 3 = 12

Group - D

6. (a) Define PIN photodiode. *[[CO6)(Analyse/HOCQ)]*
(b) Calculate external quantum efficiency. *[[CO6)(Understand/IOCQ)]*
(c) Discuss advantages over simple photodiodes. *[[CO6)(Analyse/HOCQ)]*
5 + 4 + 3 = 12
7. (a) Discuss carrier lifetime in LEDs. *[[CO3)(Remember/LOCQ)]*
(b) Explain its effect on response time. *[[CO3)(Understand/IOCQ)]*
(c) Suggest methods to reduce lifetime. *[[CO2)(Understand/IOCQ)]*
5 + 4 + 3 = 12

Group - E

8. (a) Classify different types of lasers. *[[CO6)(Remember/LOCQ)]*
(b) Explain gas and liquid lasers. *[[CO6)(Understand/IOCQ)]*
(c) Discuss one industrial application. *[[CO6)(Analyse/HOCQ)]*
5 + 4 + 3 = 12
9. (a) Explain material processing using lasers. *[[CO6)(Remember/LOCQ)]*
(b) Discuss laser cutting *[[CO6)(Understand/IOCQ)]*
(c) Write advantages in manufacturing. *[[CO6)(Analyse/HOCQ)]*
5 + 4 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	37.5	33.33	29.16

