

Subject: OPTOELECTRONICS AND COMMUNICATION

Time: 3 Hours

JUNE 2011

Max. Marks: 100

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: (2×10)

a. LED consists of the source _____

- (A) in visible region (B) in invisible region
(C) both (A) & (B) (D) none of the above

b. In fiber communication light source produces an

- (A) optical wave (B) electrical wave
(C) both (A) & (B) (D) none of the above

c. White noise consist of

- (A) flat spectrum (B) series spectrum
(C) no spectrum (D) none of the above

d. Light can be launched from

- (A) LED (B) LASER
(C) both (A) & (B) (D) none of the above

e. Absorption in fiber optical is caused by:

- (A) Absorption by atomic defects in the glass composition.
(B) Extrinsic absorption by impurity atoms in the glass material.
(C) Intrinsic absorption by the basic constituent atoms of the fiber material.
(D) All of the above.

f. The desirable properties of LASER beam are:

- (A) High radiant energy (B) Polarisation
(C) Monochromatic and coherent (D) All of the above

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- g. Photodiodes_____.
- (A) do not have any response in darkness.
(B) have a response in darkness.
(C) have a leakage current even in darkness.
(D) do not have leakage current even in darkness.
- h. One of the combinations of materials used for optical fibers is:
- (A) Copper core and glass cladding. (B) Glass core and aluminium cladding.
(C) Glass core and plastic cladding (D) Plastic core and glass cladding.
- i. In a graded index fiber the total reflected light takes a:
- (A) Straight line path (B) Parabolic path
(C) Elliptical path (D) Circular path
- j. In optical fibers, if the internal reflection is to take place, the following condition must be satisfied.
- (A) $n_2 < n_1$ and $\phi_1 > \sin^{-1}(n_2/n_1)$ (B) $n_1 < n_2$ and $\phi_1 < \cos^{-1}(n_2/n_1)$
(C) $n_2 < n_1$ and $\phi_1 < \cos^{-1}(n_2/n_1)$ (D) $n_2 > n_1$ and $\phi_1 > \cos^{-1}(n_2/n_1)$
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**Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.**

- Q.2** a. Discuss different optical fiber modes and their configuration. (8)
- b. What are the main constituents of an optical fiber communication link? Explain with the help of neat diagram. (8)
- Q.3** a. Discuss signal distortion in optical fiber. (6)
- b. A silica optical fiber has a core with refractive index 1.50 and a cladding with refractive index of 1.46. Determine: (i) Critical angle at core-cladding interface (ii) NA of fiber (iii) Acceptance angle. (5)
- c. A multimode index fiber with core diameter $80\mu\text{m}$ and relative refractive index of 1.5 is operating at a wavelength of $0.85\mu\text{m}$. If n_1 is 1.48, find: (i) Normalized frequency of the fiber (ii) Number of modes. (5)
- Q.4** a. Explain structure of laser Diodes. (8)
- b. Explain physical principle of photo diodes. (8)
- Q.5** a. Discuss mechanical misalignment in optical fiber link. (8)
- b. Describe optical fiber connectors also explain its types. (8)
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- Q.6** a. Discuss probability of error of digital receiver. (8)
- b. Explain analog receiver. (8)
- Q.7** a. How one can simultaneously send analog and digital signals by FDM them on different subcarrier frequencies. (8)
- b. Derive the carrier noise ratio. (8)
- Q.8** a. Explain line coding and error correcting codes. (8)
- b. Consider the 10 bit data using 1010011110 and the divisor 1011 use both binary and algebraic division to find the CRC. (8)
- Q.9** a. Explain SONET/SDH with their frame structure, optical interface and Networks. (8)
- b. Derive an expression to show “the losses of the linear bus increase linearly with the number of stations N. (8)