

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

**AMIETE – ET (Current Scheme)**

Time: 3 Hours

**JUNE 2016**

Max. Marks: 100

**PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.**

**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. Total internal reflection in glass occur when critical angle is
 

(A) Less than $42^\circ$	(B) equal to $42^\circ$
(C) greater than $42^\circ$	(D) None of these
- b. The light sources are differentiated based upon
 

(A) Beam width	(B) spectral width
(C) material construction	(D) beam co-efficient
- c. According to law of reflection, both incident and reflected wave lies in
 

(A) different planes	(B) incident plane
(C) reflected plane	(D) normal to incidence plane
- d. The mode field diameter in single mode fiber is given by
 

(A) $1/e^2$ width	(B) $e^2$ width
(C) $e^3$ width	(D) None of these
- e. The dispersion in the Graded index fiber when  $n=1.46$   $\Delta=0.01$  is given by
 

(A) 240 ps/km	(B) 185 ps/km
(C) equal to velocity of light	(D) 242 ps/km
- f. The cladding which surrounds the fiber core
 

(A) act to guide the light in the core
(B) ensures that the refractive index remain constant
(C) is used to protect from fire
(D) has higher refractive index
- g. The energy in which excited ions remain before making a transition in laser is
 

(A) quasistable state	(B) stable state
(C) Metastable state	(D) Bistable state
- h. Which of the following devices have highly incoherent source?
 

(A) Laser diode	(B) LED
(C) Avalanche photodiode	(D) quantum dot
- i. The three major groups in the optical system are
 

(A) The source, link and receiver
(B) The transmitter, Noise, Receiver
(C) The data rate, bandwidth and response time
(D) The source, the link and the detector

**Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION**

- j. To transform optical power into electrical power which physical effect is utilized in photon – detector?  
 (A) Photo-emissive (B) bolometric  
 (C) pyroelectric (D) both (A) and (B)

**Answer any FIVE Questions out of EIGHT Questions.  
 Each question carries 16 marks.**

- Q.2** a. Define the terms – Numerical Aperture, Critical Angle, Total Internal Reflection and Propagating Modes in the context of on optical fiber. (8)  
 b. Calculate the NA, multipath pulse broadening and the distance band width product of (8)  
 (i) Silica fiber with  $n_{\text{core}}=1.46$  and  $n_{\text{clad}} = 1$  (air)  
 (ii) Fiber with  $n_{\text{core}}= 1.465$  and  $n_{\text{clad}}=1.45$
- Q.3** a. What are the desirable properties of a source of optical communication? Compare the properties of LED and Laser Diode (LD) and comment on their suitability for optical communication. (8)  
 b. Find the core radius for a multi mode fiber that can support 1000 modes at an operating wavelength of  $1.3 \mu\text{m}$ , if the refractive index of the core is 1.5 and that of the cladding is 1.48. (8)
- Q.4** a. What do you understand by Attenuation in optical fiber? Explain the various types of core and cladding losses. (8)  
 b. Explain the concept of Pulse Broadening in Graded index wave guide. (8)
- Q.5** a. What are the important requirements of an optical receiver. Explain the Trans impedance amplifier stage in optical receiver. (8)  
 b. Define and explain the meaning of responsivity and quantum efficiency of a photodiode. Derive expression for same. (8)
- Q.6** a. Calculate the maximum optical power coupling to a source into fiber. (8)  
 b. Explain various types of mechanical misalignment from fiber to fiber joint. (8)
- Q.7** a. Explain link design equation to point to point communication link, based upon power budget and rise time budget consideration. (8)  
 b. Explain the line coding for following data i.e. NRZ-L, NRZ-I, RZ-polar, RZ-nonpolar: **0010110010** (8)
- Q.8** a. Explain the following: (8)  
 (i) Carrier to Noise ratio  
 (ii) SONET/SDH Hierarchy  
 b. Explain wavelength division multiplexing (WDM) and its importance to the optical communication. (8)
- Q.9** Write short notes on any **TWO**:- (2×8)  
 (i) Advantages of optical communication over cable communication  
 (ii) Lensing schemes for coupling improvement  
 (iii) Splicing Techniques