

Time: 3 Hours

DECEMBER 2012

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. An eye diagram is _____

- (A) a multiplexing technique (B) method to study and analyse a signal
(C) a point to point link (D) an optical source

b. Dispersion means _____

- (A) Broadening of pulse (B) Attenuation of pulse
(C) A channel (D) Fiber fabrication

c. Multiplexing is _____

- (A) Repeating the same signal
(B) Increasing the power of signal
(C) A technique by which several signals can be transmitted simultaneously
(D) Attenuating the signal

d. CDMA is _____

- (A) Carries division multiple access (B) Code division multiple access
(C) Code diversion multiple access (D) Coding multiple access

e. A photodetector _____

- (A) converts light to electrical from (B) converts electrical energy to light
(C) lights up a system (D) sends light in a fiber

f. Splicing is _____

- (A) Breaking a fiber (B) joining two fibers smoothly
(C) Bending a fiber (D) Fabricating a fiber

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

- g. LASER stands for
- (A) Light amplification by stimulated emission of radiation
 - (B) Light amplification by spontaneous emission of radiation
 - (C) Light attenuation by stimulated emission of radiation
 - (D) Light attenuation by spontaneous emission of radiation
- h. Intermodal dispersion occurs in _____
- (A) Single mode fiber
 - (B) Multimode fiber
 - (C) A channel
 - (D) A receiver
- i. DWDM is
- (A) Density Wave Division Multiplexing
 - (B) Dense & Wide Division Multiplexing
 - (C) Dry Wavelength Division Multiplexing
 - (D) Dense Wavelength Division Multiplexing
- j. LED generally used material is
- (A) Direct band gap material
 - (B) Indirect band gap material
 - (C) Both (A) and (B)
 - (D) None of these

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

- Q.2** a. What is Snell's law? Show the refraction and reflection of a light ray at a material boundary and explain what is critical angle of incidence. (6)
- b. Compare step index fiber and graded index fiber. (4)
- c. A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.5 and a cladding refractive index of 1.47. Determine
- (i) The critical angle at core cladding interface.
 - (ii) The numerical aperture for the fiber.
 - (iii) The acceptance angle in air for the fiber. (6)
- Q.3** a. Explain signal distortion in single-mode optical fiber. (6)
- b. Derive an expression for waveguide dispersion. (5)
- c. Explain how information capacity of optical fiber is determined. (5)
- Q.4** a. Compare LED and LASER as a source of light. What is population inversion? (8)

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

- b. Draw the schematic representation of a reverse biased PIN-photodiode and derive expression for primary photo current I_p . (8)
- Q.5** a. With neat sketch, explain lensing-schemes used to improve optical source-to-fiber coupling efficiency. (8)
- b. Show that the axial misalignment of 'd' is small compared with the core radius 'a'. (8)
- Q.6** a. Briefly explain the optical digital receivers performance. (8)
- b. Show the bit-error rate as a function of signal to noise ratio when the standard deviations are equal ($\sigma_{on} = \sigma_{off}$) and $b_{off} = 0$. (8)
- Q.7** a. Describe basic elements of an analog-link and the major noise contributors. (8)
- b. Explain various multichannel transmission techniques. (8)
- Q.8** a. Why is line coding an important consideration within digital optical fiber system design? (8)
- b. What are Block codes? (8)
- Q.9** Write short notes of any **TWO**:-
- (i) Ultra-high capacity networks
(ii) Scattering Matrix Representation
(iii) Star couplers (2×8)