ROLL NO. _____

Code: AE24 Subject: OPTO ELECTRONICS AND OPTICAL COMMUNICATION

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **JUNE 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. Index Difference Δ for single mode fibers typically ranges from

(A) 1 to 3 % **(B)** 2 to 4 %
(C) 0.2 to 1 % **(D)** 1.5 to 2 %

b. Bound and Unbound rays are types of

(A) Meridional rays **(B)** Skew rays
(C) Both **(D)** None

c. As the angle of incidence ϕ_1 in an optically denser material becomes larger, the refracted angle ϕ_2 approaches

(A) π **(B)** $\pi/2$
(C) $3\pi/4$ **(D)** 2π

d. As light travels along a fiber, the relation of its power to distance is that it

(A) Decreases exponentially **(B)** Decreases linearly
(C) Increases exponentially **(D)** Increases linearly

e. Attenuation Coefficient of an optical fiber is commonly expressed in

(A) km^{-2} **(B)** Nepers
(C) dBm **(D)** Decibles per kilometer

f. Dispersion is given as

(A) $D = \left(1/L\right) d\tau_g / d\lambda$ **(B)** $D = L\, d\tau_g / d\lambda$

(C) $D = \left(1/L\right) d\lambda / d\tau_g$ **(D)** $D = L\, d\lambda / d\tau_g$

g. The emission pattern of edge emitter LED as compared to surface emitter LED is

(A) Less Directional **(B)** Equally Directional
(C) More Directional **(D)** May be equal or less Directional

h. Mass action law is

(A) $np^2 = n_i$ **(B)** $(np)^2 = n_i$
(C) $n^2p = n_i^2$ **(D)** $np = n_i^2$

i. Bit Error Rate (BER) is denoted as

(A) $BER = N_t / N_e$ **(B)** $BER = N_e * N_t$
(C) $BER = N_e / N_t$ **(D)** $BER = N_e * N_t^2$

j. Series of ANSI T1.105 standards are specified for

(A) SDH **(B)** WDM
(C) STM-16 **(D)** SONET

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

Q.2 a. Draw and explain the operating range of optical fiber systems and the characteristics of the four key link components. **(8)**

b. Enumerate the advantages of an optical Fiber Communication. **(8)**

Q.3 a. Derive the expression for Numerical Aperture (NA) of a step index fiber for meridional rays. **(8)**

b. (i) An optical fiber in air has an NA of 0.4. Compare the acceptance angle for meridional rays with that for skew rays which change direction by 100º at each reflection. **(4)**
(ii) Discuss the mechanical properties which must be taken care of while designing the optical cable. **(4)**

Q.4 a. Differentiate between Step index Fibers and Graded index fibers. **(8)**

b. What is Fiber Splicing? Explain the various types of Splices. **(8)**

Q.5 a. Explain optical emission from Semiconductor Injection Laser and define its operational efficiency. **(8)**

b. A double-heterojunction InGaAs LED emitting at a peak-wave length of 1310 nm has radioactive and nonradioactive recombination life times of 30 and 100 ns, respectively. The drive current is 40 mA. Calculate:

(i) the bulk recombination life time
(ii) the internal quantum efficiency
(iii) internal power level **(8)**

Q.6 a. Explain avalanche photodiode principle and compare its benefits and drawbacks with photodiodes. **(8)**

b. Explain the optical pulse detection mechanism mentioning the various noises associated with it. **(8)**

Q.7 a. Give LED characteristics. **(12)**

b. GaAs has a bandgap energy of 1.43eV at 300 K. Determine the wavelength above which an intrinsic photodetector fabricated from this material will cease to operate. **(4)**

Q.8 a. Draw and explain an optical power loss model for a point-to-point link. **(8)**

b. Explain Line Coding and give the various types of binary codes that are well suited for digital transmission on an optical fiber link. **(8)**

Q.9 a. Elaborate Multichannel Amplitude Modulation. **(6)**

b. Explain how WDM networks extend the versatility of communication networks. **(10)**