ROLL NO. _____

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICA

AMIETE – ET (NEW SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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. Optical communication generally takes place at

(A) 10^5 Hz **(B)** 10^{14} Hz
(C) 1000 Hz **(D)** 10^7 Hz

b. If the output power in an optical fibre is half of that of input power, then the loss is

(A) $10\log_{10} 2$ **(B)** $10\log_{10} \frac{1}{2}$
(C) $20\log_{10} 2$ **(D)** $20\log_{10} \frac{1}{2}$

c. The type of emission that takes place in a LASER is

(A) Spontaneous **(B)** Stipulated
(C) Stimulated **(D)** Direct

d. A fiber connector is generally

(A) Demountable joint **(B)** An optical bend
(C) A permanent bond **(D)** An optical source

e. To convert electrical input pulses to optical power pulses, we need

(A) LED or LASER **(B)** Photodetector
(C) Decision circuit **(D)** Filter

f. To analyse the performance of Analog Systems, we usually calculate

(A) ratio of peak-to-peak carrier power to peak-to-peak noise power
(B) ratio of rms carrier power to peak-to-peak noise power
(C) ratio of rms carrier power to rms noise power
(D) ratio of half of carrier power to half of noise power

g. The two basic schemes for improving the reliability of data transmission are

(A) ART and FEB **(B)** PRT and FEC
(C) ARP and CEF **(D)** ARQ and FEC

h. Wavelength division multiplexing is

(A) technology of combining a number of bits
(B) technology of combining a number of wavelengths onto the same fiber
(C) technology of transmitting different wavelengths together through different fibers
(D) technology of dividing one channel into different time slots

i. For a 2×2 fiber coupler, which of the following is not a measure of performance of optical coupler.

(A) Splitting ratio **(B)** Insertion loss
(C) Crosstalk **(D)** Carrier to noise coupling

j. Polarization mode dispersion (PMD) is significant in

(A) Multimode fiber only **(B)** Single mode fiber only
(C) Both **(A)** and **(B)** **(D)** None of the above

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

Q.2 a. Explain the structure of a fiber. Why is refractive index of cladding slightly less than that of core? What is graded index fiber? **(8)**

b. Draw a curve taking wavelength in nm on x-axis and attenuation in dB/km on y-axis. Also indicate the three windows or the operating regions for optical communication. **(8)**

Q.3 a. Explain any **TWO** of the following:-
(i) Absorption in optical fibres (ii) Bending losses
(iii) Scattering losses **(8)**

b. Consider a 30 km long optical fiber that has an attenuation 0.8 dB/km at 1300 nm. Find the output optical power if 200 μW of optical powers is launched into the fiber. **(4)**

c. What is mode coupling? **(4)**

Q.4 a. Differentiate
(i) LED and LASER
(ii) PIN and APD photo-detectors. **(8)**

b. Consider an InGaAs PIN photodiode with a quantum efficiency of 0.6. Calculate the responsivity at 1300 nm & 1500 nm. Why is responsivity is larger at 1550 nm? **(8)**

Q.5 a. Which type of LED can be used to launch power in single mode fibers and why? **(6)**

b. A single mode fiber has a normalized frequency V=2.40, a core refractive index n_1=1.47, a cladding refractive index n_2=1.465 and a core diameter 2a=9 μm. Find the insertion losses of a fiber joint having a lateral offset of 1 μm. **(10)**

Q.6 a. What is Bit Error rate? How is it measured? What are the various error sources in an optical receiver? **(10)**

b. Draw the schematic diagram of a typical optical receiver. **(6)**

Q.7 a. In broadband analog applications such as cable television (CATV) supertrunks we need to send multiple analog signals over the same fiber. What all techniques could be used to achieve this? Compare them. **(12)**

b. Explain Carrier to Noise Ratio. **(4)**

Q.8 a. Obtain the RZ, NRZ, AMI and Manchester line codes for the data stream 1100010011101. **(8)**

b. Explain any two basic schemes for improving the reliability of data transmission. **(8)**

Q.9 Explain any **TWO** of the following:

(i) Semiconductor optical amplifier
(ii) SONET
(iii) Optical CDMA
(iv) WDM **(8+8)**