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

AMIETE – ET (Current Scheme)

Time: 3 Hours | **DECEMBER 2015** | 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. A step-index fibre has a core with a refractive index of 1.50 and a cladding with a refractive index of 1.46. Its numerical aperture is

   (A) 0.156   **(B)** 0.244
   (C) 0.344   **(D)** 0.486

b. In a multimode SI fibre, the higher order modes propagate within the fibre with

   (A) Lower group velocity than the lower order modes.
   (B) Higher group velocity than the lower order modes.
   (C) Same group velocity as that of lower order modes.
   (D) Random group velocity.

c. Pulse broadening in GI fibres is due to

   (A) Intermodal dispersion   **(B)** Intramodal dispersion
   (C) Both **(A)** and **(B)**   **(D)** None of these

d. Which of the following pairs are suitable for making a heterojunction?

   (A) Si and Ge   **(B)** Si and GaAs
   (C) GaAs & AlAs   **(D)** GaAs & GaAlAs

e. Increase in the concentration of GeO_2 in SiO_2 will

   (A) Decrease the RI   **(B)** Increase the RI
   (C) Change RI randomly   **(D)** Not change RI at all

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f. Which of the following detectors give amplified output?

(A) p-n photodiode   (B) p-i-n photodiode
(C) Avalanche photodiode   (D) Photovoltaic detector

g. The scheme of WDM is similar to

(A) FDM for RF transmission   (B) TDM
(C) SDM   (D) OTDM

h. A 1 x 10 coupler has an input signal 0 dBm. What is the power level at each output port?

(A) 0 dBm   (B) –1 dBm
(C) –3 dBm   (D) –10 dBm

i. What is the bit duration of a 2.5 Gbits/s signal?

(A) 2.5 ns   (B) 1 ns
(C) 0.4 ns   (D) 0.1 ns

j. Optical amplifiers can be used as

(A) In-line amplifiers to compensate for loss
(B) Power amplifiers to follow the transmitter
(C) Pre-amplifiers to precede the receiver
(D) All of these

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

Q.2 a. Discuss the basic components of an optical communication system with block diagram. **(8)**

b. Briefly discuss the fibre classification based on modes of propagation and index profile. Draw index profile of various types of fibres. **(8)**

Q.3 a. Briefly explain the reasons for pulse broadening due to material dispersion in optical fibre. **(8)**

b. A given step-index fibre has a core refractive index of 1.480, a core radius equal to 4.5 µm, and a core-cladding index difference of 0.25 percent. What is the cut off wavelength for this fibre? **(8)**

Q.4 a. What are direct band-gap and indirect band-gap semiconductors? Give at least two examples of each. Which of these are suitable for fabricating LEDs and why? **(8)**

b. What do you meant by responsivity of photodetector? Discuss the factors responsible for limiting the speed of response of photodiode. **(8)**

Q.5 a. Discuss various lensing schemes used for the improvement of coupling of light to the fibre and outline the technique deployed for the LED coupling to Single Mode Fibre. **(8)**

b. What do you understand by optical fibre connectors? List all the necessary requirements of a good connector. Also, discuss the popular alignment schemes used in optic connectors. **(8)**

Q.6 a. Derive an error probability expression for a digital receiver. **(8)**

b. How can we measure the performance fidelity for an analog receiver in terms S/N ratio? **(8)**

Q.7 a. Explain the implementation of an Analog Fibre Optic System. How will you analyse the performance of analog system through CNR? **(8)**

b. Explain the following: **(8)**
(i) Multichannel Amplitude Modulation
(ii) Subcarrier Multiplexing

Q.8 a. Explain the following terms in context with Point - to - Point Links for Digital Transmission:
(i) Link Power Budget
(ii) Rise Time Budget
(iii) Short Wavelength Band **(8)**

b. What do you understand by error correction & detection in optical fibre communication? Enlist all the techniques employed for correction & detection purpose. Explain one for each. **(8)**

Q.9 a. Define WDM? With the help of schematic, explain the operational principles of WDM. **(8)**

b. Briefly explain the following:- (any **TWO**)
(i) SOA
(ii) SDH/SONET
(iii) Optical CDMA **(8)**