Code: AE75   Subject: OPTOELECTRONICS AND COMMUNICATION

AMIETE – ET (Current Scheme)

Time: 3 Hours   **June 2017**   **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.   Which of the following is not a common type of fiber optic cable?
   (A) Single-mode step-index
   (B) Multi-mode graded-index
   (C) Single-mode graded-index
   (D) Multimode-mode step-index

b.   A glass fiber has core material of refractive index 1.466 and Cladding material of refractive index 1.46. If it is surrounded by air, the critical angle at the core cladding interface would be
   (A) 81.84   **(B)** 84.81
   (C) 430   **(D)** None of these

c.   Typically, glass fibers have minimal chromic dispersion characteristics at a center wavelength near
   (A) 780 nm   **(B)** 850 nm
   (C) 1300 nm   **(D)** 1500 nm

d.   A fiber has 150 m length and is fed with an optical power of 10 µW. The output power is found to be 8 µW. The loss in dB/km would be
   (A) -6.64 dB/km   **(B)** 6.64 dB/km
   (C) -6.46 dB/km   **(D)** -6.00 dB/km

e.   Which one is not true for plastic fiber?
   (A) have low NA
   (B) High attenuation
   (C) have very poor mechanical strength
   (D) Have low maximum operating temperature

f.   Performance index of a digital optical receiver is given by
   (A) S/N ratio   **(B)** Noise figure
   (C) Bit error rate   **(D)** None of these

g. Which type of injection laser involves the use of geometry for fabrication of the multimode injection laser with a single or small number of lateral modes?
(**A**) Gain guided laser   (**B**) Index guided laser
(**C**) Quantum well laser   (**D**) Quantum dot laser

h. What is the insertion loss of connector-type splices for a single mode fiber optics?
(**A**) 0.31 dB   (**B**) 0.38 dB
(**C**) 0.49 dB   (**D**) 0.51dB

i. The features of digital transmission system are
(i) Simple design
(ii) produce cost effective means of data communication
(iii) no nonlinearity problems
(**A**) (ii) and (iii)   (**B**) (i) and (iii)
(**C**) (i) and (ii)   (**D**) (i), (ii) and (iii)

j. SONET/SDH is a synchronous network using synchronous
(**A**) TDM multiplexing   (**B**) CDMA multiplexing
(**C**) TDM duplexing   (**D**) CDMA duplexing

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

Q.2 a. Discuss four features of Linearly Polarised (LP) mode.   **(6)**

b. Define and compare (i) Bounded Mode (ii) Radiative Mode (iii) Leaky mode and obtain the cutoff condition for bounded mode.   **(6)**

c. Discuss tensile strength and fatigue for optical fibres.   **(4)**

Q.3 a. Calculate the waveguide dispersion in units of ps/km for a 9/125 single mode fiber with n_1=1.48, D=22% operating at 1.3 µm, Core diameter = 9 µm and cladding diameter = 125 µm.   **(5)**

b. Discuss scattering loss in optical fiber.   **(5)**

c. Explain in detail the design optimization of single mode fiber.   **(6)**

Q.4 a. Discuss structure and features of Distributed feedback laser. Compare it with Distributed Bragg reflector laser.   **(5+3)**

b. Explain the working of a reach-through Avalanche Photo Diode (RAPD) with suitable diagram. A detector operating at 800 nm produces an output current of 80µA for an incident light beam of power 800W. Calculate the quantum efficiency and responsibility of the detector.   **(4+4)**

Q.5 a. Define radiance and coupling efficiency. Derive the expression for power launched into a step index fiber from a surface emitted LED. **(8)**

b. What are splices? Discuss Electric arc fusion; V groove and elastic tube splice techniques with appropriate diagram. **(8)**

Q.6 a. Discuss the different types of noises in detector that may affect the signal to noise ratio (S/N) in the optical receiver of fiber optic system. Find an expression for S/N ratio for an APD receiver with avalanche gain M. **(8)**

b. Discuss the need of preamplifiers. What are the various types of preamplifiers? Explain with features each type of preamplifier. **(8)**

Q.7 a. Using block diagram show the basic elements of Analog link. What are the major noise contributors of an analog link? **(8)**

b. Define Relative intensity Noise (RIN) and Carrier to noise ratio. What will be the effect of injection current level in RIN? **(8)**

Q.8 a. What is line coding? What are the various line encoding techniques used in optical fiber communication? Describe any three line coding scheme. **(8)**

b. Discuss the polynomial code used for error detection and outline the basic CRC procedure. **(8)**

Q.9 a. What is DWDM? How it created a revolution in high capacity optical fiber transmission. A DWDM optical transmission system is designed to have 100 GHz channel spacing. How many wavelength channels can be utilized in the 1536 to 1556 nm spectral band? **(8)**

b. Briefly explain the following:- (any TWO) **(8)**
   (i) DWDM
   (ii) Semiconductor Optical Amplifier (SOA)
   (iii) Ultrahigh Capacity Networks