ROLL NO. _____

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

AMIETE – ET (Current Scheme)

Time: 3 Hours **DECEMBER 2018** **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 multimode step index fiber has a core radius 'a' of 40 μm and clad radius 'b' of 50 μm. The refractive index of core is 1.4 and Δ = 10%. What is the light gathering power?
(A) 0.62 **(B)** 0.38
(C) 0.44 **(D)** None of these.

b. Light is guided within the core of the step index fiber by
(A) Refraction at the core – air interface
(B) Total internal reflection at the core cladding interface.
(C) Total internal reflection at the outer surface of the core
(D) Change in the speed of light within the clad

c. The dominant mode of single mode fiber is
(A) .HE_{10} **(B)** .HE_{11}
(C) .HE_{01} **(D)** .HE_{00}

d. _____ misalignment is more commonly occurring one in practice.
(A) End separation **(B)** Angular
(C) Lateral **(D)** None of these

e. _____ laser cavity is generally used for lasing.
(A) Triangular **(B)** Circular
(C) Non directional **(D)** Fabry – Perot

f. _____ is the typical value of splice loss.
(A) 4 dB **(B)** 2 dB
(C) 1 dB **(D)** 0.1 dB

g. _____ splicing technique is easier to use in practice.
(A) Elastic tube **(B)** Fusion
(C) Opta **(D)** Mechanical tube

h. The PRBS required to generate the eye pattern is obtained using
(A) Decade counter **(B)** Shift register
(C) Basic gates **(D)** FFs

i. Optical amplifiers can be used for
(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

j. If the number of wavelength channels in a WDM system is 10, what will be the number of frequencies created by four wave mixing?
(A) 30 **(B)** 100
(C) 450 **(D)** 900

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

Q.2 a. Derive and explain the relation between Numerical aperture and acceptance angle. **(5)**

b. Give an account on materials for fiber fabrication. **(5)**

c. Define and explain skew rays. An optical fiber in air has a NA of 0.4. In this fiber, skew rays change direction by 100^0 at each reflection. Find out the acceptance angle of Skew rays. **(6)**

Q.3 a. An optical signal at a specific wavelength has lost 55 percent of its power after traversing 7.0 km of fiber. What is the attenuation in dB/km of this fiber? **(5)**

b. A step-index fiber 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 percents. What is the cutoff wavelength for this fiber? Assume V = 2.405 **(5)**

c. Mathematically analyze the pulse broadening effect in multimode step index fibers **(6)**

Q.4 a. Derive the Einstein relation for lasers. **(5)**

b. Discuss the different cavities used for lasing with neat diagrams. **(5)**

c. Explain the construction and operating principles of APD. Derive its parameters. **(6)**

Q.5 a. Explain the methods to enhance light coupling between LED and single mode fibers. **(6)**

b. Explain the different types of fiber connectors with neat diagrams. **(6)**

c. Give an account on : Fiber misalignments **(4)**

Q.6 a. Explain the types of preamplifiers with diagrams. **(8)**

b. Explain the concept of analog optical receiver with a neat diagram. **(8)**

Q.7 a. Explain the different multichannel transmission techniques. **(10)**

b. Derive an expression for Carrier to Noise Ratio. **(6)**

Q.8 a. What are the special features of DWDM? Explain with an example. **(5)**

b. A 128×128 broadcast star is made by using 2×2 directional couplers, each having an insertion loss of 0.1 dB. Each channel transmits 0.5 mW of average power and requires 1μW of average received power for operation at 1 Gb/s. What is the maximum transmission distance for each channel? Assume a cable loss of 0.22 dB/km and a loss of 1.5 dB from connectors and splices. **(5)**

c. Explain the significance of point to point optical link in detail, with examples. **(6)**

Q.9 a. Compare and contrast the parameters of different optical amplifiers. **(6)**

b. Explain the different configurations of EDFA. Consider an EDFA being pumped at 980 nm with a 30 mW pump power. If the gain at 1550 nm is 20dB, calculate
(i) The maximum input power
(ii) The maximum output power. **(6)**

c. Discuss the functions of each SONET / SDH layer in detail. **(4)**