ROLL NO. _____

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

AMIETE – ET (Current Scheme)

Time: 3 Hours **December 2016** **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. The relation of refractive index for core (n_1) and cladding (n_2) is
(A) $n_1 > n_2$ **(B)** $n_1 < n_2$
(C) $n_1 = n_2$ **(D)** None of these

b. Critical Angle describes
(A) The point at which light become invisible
(B) The point at which light has crossed the boundary layers from one index to other
(C) The point at which light is reflected
(D) All of these

c. Chromatic dispersion in fibres is caused due to
(A) Wavelength **(B)** Refractive index
(C) High data rate **(D)** Colour

d. Laser is based on the principle of
(A) Spontaneous emission **(B)** Radiated emission
(C) Stimulated emission **(D)** All of these

e. Noise equivalent power of a photodiode is
(A) Maximum signal power that produces SNR = 1
(B) Minimum signal power that produces SNR = 1
(C) Maximum noise power that produces SNR = 1
(D) Minimum noise power that produces SNR = 1

f. The optical carrier frequencies are typically in the range of
(A) KHz **(B)** MHz
(C) GHz **(D)** THz

g. Determine the NA of a single mode fibre where $n_1 = 1.4675$ and $n_2 = 1.4622$
(A) 0.234 **(B)** 0.140
(C) 0.125 **(D)** 0.106

h. A LED emits light having a peak wavelength of 890 nm have radiative recombination time of 100ns. If the bulk recombination life time is 130ns and drive current is 14mA. Determine the non radiative recombination time.
(A) 235 ns **(B)** 149 ns
(C) 450 ns **(D)** 433 ns

i. Optical communication technology works at wavelength of
(A) 850 nm **(B)** 1300 nm
(C) 1550 nm **(D)** All of these

j. Pumping is a process to
(A) Extract energy from atoms to shift from higher to lower level
(B) Feed energy to atoms to shift from lower to higher level
(C) Stabilize atoms in the same energy level
(D) None of these

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

Q.2 a. Discuss various modes of propagation in single mode fibre and classify the fibre according to these modes. **(8)**

b. A silica glass optical fibre has a core refractive index of 1.50 and the cladding refractive index of 1.450. Calculate: **(8)**
(i) The critical angle for core cladding interface
(ii) The acceptance angle for core cladding interface
(iii) The numerical aperture of fibre
(iv) The percentage of light collected by the fibre assuming that the diameter of the core of fibre is greater than the diameter of the light source.

Q.3 a. List three major causes of attenuation in an optical fibre and explain their mechanism in detail. **(8)**

b. Explain in detail the reason of pulse broadening in graded index fibre. **(8)**

Q.4 a. Derive the expression for quantum efficiency and power in a light emitting diode. **(8)**

b. Explain laser diode modes and derive laser diode rate equation. **(8)**

Q.5 a. Explain mechanical misalignment problem when joining two fibres in detail. **(8)**

b. List the principle requirements of a good optical fibre connector along with its type. **(8)**

Q.6 a. Discuss noise and bandwidth consideration for trans-impedance and high speed circuits. Write their advantages and disadvantages. **(8)**

b. Explain the principle of operation of optical receiver with the help of neat block diagram. **(8)**

Q.7 a. Compare various multichannel transmission techniques by taking any four parameters in detail. **(8)**

b. Explain the effect of reflection on RIN along with its limiting conditions. **(8)**

Q.8 a. Explain link design equations in point to point communication link, based on power budget and rise time budget consideration. **(8)**

b. Discuss the need of line coding techniques in optical fibre link and illustrate the types of coding by taking a suitable example. **(8)**

Q.9 a. Discuss the principle of operation of semiconductor optical amplifier and derive the equation for amplifier gain. **(8)**

b. Write short notes on **<u>any two</u>** of the following: **(8)**
(i) Optical CDMA (ii) SONET/SDH (iii) WDM