ROLL NO. _____

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

AMIETE – ET

Time: 3 Hours **JUNE 2014** **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. What is the frequency limit of wire-pairs?

(A) Approximately 0.5 MHz **(B)** Approximately 1.0 MHz
(C) Approximately 40 GHz **(D)** None of these

b. The angle of incidence is between

(A) Incident ray and Normal line
(B) Normal line and Refracted ray
(C) Incident ray and Reflected ray
(D) Incident ray and Material boundary

c. Higher the index number

(A) Higher the speed of light
(B) Lower the speed of light
(C) As no effect on speed of light
(D) Shorter the wavelength propagation

d. A single fibre can handle as many voice channel as

(A) A pair of copper conductors **(B)** A 1500 pair cables
(C) A 500 pair cables **(D)** A 1000 pair cables

e. The term power budgeting refers to

(A) The cost of cable connector, equipments and installation
(B) The loss of power due to defective components
(C) The total power available minus the attenuation losses
(D) The comparative cost of fibre and copper installation

f. The three major groups in the optical system are:

(A) The components, data rate and response time
(B) The source, the link and the receiver
(C) The transmitter, the cable and the receiver
(D) The source, the link and the detector

g. The mechanical splice is best suited for

(A) Quicker installation under ideal conditions
(B) Minimum attenuation losses
(C) Field service conditions
(D) Situations in which cost of equipment is not a factor

h. The term Critical angle describes:

(A) The point at which light is refracted
(B) The point at which light become invisible
(C) The point at which has gone from the refractive mode to reflective mode
(D) The point at which light has crossed the boundary layers from one index to another

i. The term responsivity as it applies to a light detector is best described as

(A) The time required for the signal to go from 10% to 90% of maximum amplitude
(B) The ratio of diode output current to optical input power
(C) The ratio of input power to output power
(D) The ratio of output current to input current

j. The cladding which surrounds the fibre core

(A) is used to reduce optical interference
(B) is used to protect the fibre
(C) act to guide the light in the core
(D) ensure that the refractive index remains constant

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

Q.2 a. Show that any two orthogonal plane waves can be combined into a linearly polarized wave. **(8)**

b. Determine the maximum possible core diameter which can give a single mode operation for a graded index fibre having a parabolic refractive index profile with core refractive index of 1.45 and a relative index difference of 1.5%. The wavelength of operation being 0.85 μm. **(8)**

Q.3 a. Discuss the absorption losses in optical fibre with relation to intrinsic and extrinsic absorption mechanism. Explain how relay scattering accounts for the losses in optical fibres. **(8)**

b. Explain material dispersion and waveguide dispersion. Find an expression for material and wave guide dispersion using electromagnetic field theory. **(8)**

Q.4 a. Explain with neat sketch temperature dependent behaviour of the optical power as a function of the bias current for a particular laser diode. **(8)**

b. A P-N Photodiode has a quantum efficiency of 50% at a wavelength of 0.9 μm. Calculate:
(i) its responsivity at 0.9μm
(ii) the received optical power if mean photocurrent is 10^{-6} amp
(iii) the corresponding number of received photons at this length **(8)**

Q.5 a. Explain lateral misalignment problem when joining two fibres. **(6)**

b. Write short note on injection laser to fibre coupling. **(5)**

c. An LED has an injection efficiency of 80 % and light extraction efficiency of 60%. If overall efficiency is 2.5% and non radiative life time is 10ns. Calculate the radiative lifetime. **(5)**

Q.6 a. Discuss noise and bandwidth consideration for the cases of trans-impedance and high impedance receiver. Write their merits and demerits. **(8)**

b. What are the requirements of an optical receiver? Using a flow chart, explain the receiver design. **(8)**

Q.7 a. Explain the following:
(i) CTB
(ii) CSO
(iii) Multichannel Frequency Modulation **(8)**

b. Explain reflection effects on RIN and its limiting conditions. **(8)**

Q.8 a. Explain briefly:
(i) First-window transmission distance
(ii) Transmission distance for single-mode links **(8)**

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

Q.9 Write short notes of any **TWO**:-

(i) Multi channel transmission techniques
(ii) Applications of optical amplifiers
(iii) Optical CDMA **(2×8)**