AMIETE – ET (NEW SCHEME) - Code: AE75

Subject: OPTOELECTRONICS AND COMMUNICATION

JUNE 2010

Time: 3 Hours **Max. Marks: 100**

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.**
- **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. Carrier used to convey information in optical communication system is _____.

(A) Sound waves **(B)** Light waves
(C) VHF wave **(D)** Millimeter wave

b. Total internal reflection occurs when angle of incidence is _____.

(A) 90° **(B)** more than 90°
(C) Less than critical angle **(D)** More than critical angle

c. While selecting material for optical fibers, following requirements should be met

(A) Should be able to make long, thin and flexible fibers from the materials.
(B) Material must be transparent at a particular wavelength in order to guide light efficiently.
(C) Availability of physically compatible materials with slightly different refractive indices for core and cladding.
(D) All of the above.

d. Attenuation of light, as it propagates, is caused by _____.

(A) Absorption **(B)** Scattering
(C) Radiation losses **(D)** All of the above

e. To couple a light source in to fiber following is required:

(A) High radiance of light source **(B)** Small length of fiber
(C) Long length of fiber **(D)** None of above

f. While joining two fibers , following misalignment should be avoided:

(A) Lateral misalignment **(B)** Longitudinal misalignment
(C) Angular misalignment **(D)** All the above.

g. One of the main demands of photo detectors used in optical communication

system is _____.

(A) high sensitivity **(B)** small in size
(C) low cost **(D)** None of the above

h. While designing point-to-point optical communication system, following points should be considered

(A) Should it be single mode or multimode
(B) Light source should be LED or Laser
(C) Both **(A)** and **(B)**
(D) Neither **(A)** nor **(B)**

i. Wavelength Division Multiplexing (WDM) is carried out _____.

(A) to increase the life of light source
(B) to achieve capacity upgrade of an existing channel
(C) to avoid mode coupling
(D) to eliminate scattering losses

j. When two networks, that use different information exchange rules (protocols), are interconnected, the device used at interconnection point to translate the information from one protocol to another is called _____.

(A) Switch **(B)** Router
(C) Modem **(D)** None of the above

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

Q.2 a. With the help of a diagram, explain the working of various components of an optical communication system. **(8)**

b. Determine the value of critical angle and Numerical Aperture for light propagating from a medium having refractive index of 1.5 in to another medium having refractive index of 1.47. **(8)**

Q.3 a. What is attenuation? Explain the various reasons of attenuation. **(8)**

b. A silica fiber has measured losses of 1.5 dB/ km at 1.3 micro meter and 0.5 dB/km at 1.5 micro meter. If a total fiber loss of 20 dB can be tolerated in a single link then determine appropriate repeater spacing for operation at 1.3 micrometer and 1.5 micrometer. **(8)**

Q.4 a. Explain absorption, spontaneous emission and stimulated emission. **(8)**

b. An injection laser has a GaAs active region with a band gap energy of 1.43eV. Estimate the wavelength of optical emission from the device. **(8)**

Q.5 a. What are the differences between splices and connectors? **(2)**

b. Explain various types of mechanical misalignments that may occur while connecting two fibers. **(7)**

c. An optical source with refractive index of 3.6 is connected to a silica fiber having a refractive index of 1.48. Find the loss in dB due to Fresnel reflection. **(7)**

Q.6 a. Describe briefly the main types of noises that get added in an optical communication link? **(8)**

b. Draw the configuration of an optical receiver and discuss its operation. **(8)**

Q.7 Explain the following Multichannel transmission techniques:-

(i) Multichannel amplitude modulation **(5)**

(ii) Multichannel frequency modulation. **(5)**

(iii) Subcarrier multiplexing. **(6)**

Q.8 a. You have been asked to design an optical fiber link between two points. What points you will keep in mind while designing the link. **(12)**

b. Consider a 1550 nm laser diode that launched +3 dBm (2mW) optical power level into a fiber fly lead, an InGaAs APD with a -32dBm / km sensitivity at 2.5 Gb/ s, and a 60 km long optical cable with a 0.3dB/ km attenuation. Assume that here, because of the way equipment is arranged, a short optical jumper cable is needed at each end between the end of transmission cable and SONET equipment rack. Assume that each jumper cable introduces a loss of 3dB. In addition assume a 1dB connector loss occurs at each fiber joint. (two at each end because of the jumper cables). **(4)**

Q.9 a. What is Wavelength division multiplexing (WDM)? Discuss its key features and operation. **(8)**

b. What are the various topologies being followed in optical networking? **(8)**