AMIETE – ET (NEW SCHEME) - Code: AE75

Subject: OPTOELECTRONICS AND COMMUNICATION

Time: 3 Hours

DECEMBER 2010

75 TION 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.
- The answer sheet for the Q.1 will be collected by the invigilator after half an hour 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. An optical fibre has core & cladding refractive indices of 1.55 & 1.50 respectively. The numerical aperture of the fibre is

(A) 0	(B) 1
(C) 0.394	(D) 0.493

b. The wavelength of a light wave in free space for a frequency of 600 GHz & velocity, 3×10^8 m/sec is

(A) 1 μm	(B) 0.5 μm
(C) 1.5 µm	(D) 2 μm

c. A step index fibre has a core diameter of 200 μ m & NA = 0.29. The number of propagating modes at an operating wavelength of 850 nm is

(A) 100	(B) 22953
(C) 35922	(D) 10,000

d. The permittivity of the fibre core is 2.56, diameter = 1cm, $\mu_2 = 1$ & cut – off number = 2.4048. The maximum frequency of the dominant mode is

(A) 18.373 GHz	(B) 81.373 GHz
(C) 373.81 GHz	(D) 373.18 GHz

e. The optical power after propagating through a fibre of 450 m length is reduced to 30% of it's original value. The fibre loss in dB/ km is

(A) 26.11	(B) 11.62
(C) 1000	(D) 0

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f. The intermodal dispersion per km for a fibre with $\Delta = 2\%$ & $\mu = 1.5$, is

(A) 100 ns	(B) 001 ns
(C) 1000 ns	(D) 0 ns

StudentBounts.com g. When a LED in applied with 2V, draws a current of 100 mA & produces 2mW of optical power. The conversion efficiency of the LED is

(A) 0%	(B) 100%
(C) 1%	(D) 50%

h. Germanium has a bandgap of 0.667eV. A germanium PIN diode has a cut - off length of

(A) 1.86 μm	(B) 18.6μm
(C) 0.186µm	(D) 1861 μm

i. An LED with a fibre pigtail of diameter $200 \,\mu m$ couples power into a 50 µm graded index core coupling loss is.

(A) 1 dB	(B) 12 dB
(C) 0 dB	(D) 24 dB

j. The velocity of light in an optically active medium with a refractive index of 3.6 is

(A) $3.38 \times 10^7 \mathrm{m/s}$	(B) $33.8 \times 10^7 \mathrm{m/s}$
(C) $8.33 \times 10^7 \mathrm{m/s}$	(D) $3 \times 10^7 \mathrm{m/s}$

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

- Q.2 a. Discuss the significance of any FOUR of the following terms in optical fibres.
 - (i) Snell's law
 - (ii) Acceptance angle
 - (iii) Numerical aperture
 - (iv) Skew rays
 - (v) V number
 - b. Draw a block diagram of a general optical communication system. Explain the blocks which are different from an electronic communication system. (8)
- **Q.3** a. What is the physical significance of eye diagrams and also explain different Eye pattern features. (8)
 - b. Compare various coherent detection techniques. (8)

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(8)

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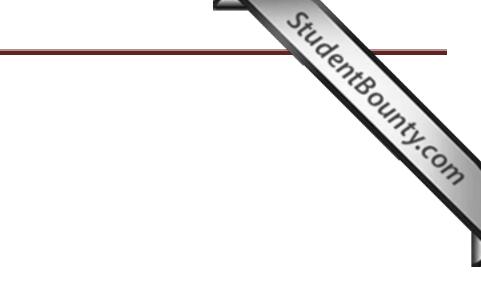
Q.4 What is intermodal dispersion? Derive an expression for rms impulse a. intermodal dispersion with respect to multimode step index fibres

- b. Write a short note on
 - (i) Scattering.
 - (ii) Absorption.
 - (iii) Dispersion shifted fibers.
- StudentBounty.com **Q.5** a. What do you understand by lensing scheme. Explain different lensing schemes for coupling improvement. (10)
 - b. Compute the macrobend loss of a single mode fibre with core diameter of $10 \,\mu\text{m}$ & cut off wavelength 1250 nm, which is bent into a curve of radius R = 1.2 cm. the refractive index is 1.4469. Also, calculate the mode field diameter. Take $\lambda = 1.3 \ \mu m$ (6)

0.6 a. Discuss the principle of operation & applications of (10)(i) Fabry – perot filters (ii) Mach - zehnder interferometer

- b. A fibre of 100 km long is used in a communication system. The fibre has a loss of 3.0 dB / km. What will be the output power when the power fed at the input of the fibre is 500 µW (6)
- 0.7 a. What are the key requirements for analyzing a link and system considerations to establish a link power budget. (8)
 - b. What is the importance of rise time budget, derive an expression for total rise time system. (8)
- **Q.8** a. What are the basic elements of an analog link and how noise contribute this link. (6)
 - b. How do we analyze the performance of analog and digital systems and also examine a single-channel amplitude-modulated signal sent at baseband frequencies. (10)
- (10) 0.9 a. With necessary diagrams, explain SONET frame structure.
 - b. Explain how optical trace & optical alarms assist in network management. (6)

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