Printed Pages: 4 NEC -701

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2012425 Roll No.

B.TECH

Regular Theory Examination (Odd Sem-VII), 2016-17

OPTICAL COMMUNICATION

Time : 3 Hours *Max. Marks : 100*

SECTION - A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)

a) Write down the wavelength regions corresponding to first, second and third windows.

b) A silica optical fiber with a core refractive index of 1.50 and a cladding refractive index of 1.47. Determine the numerical aperture for the fiber.

c) List the properties of optical fiber that results in signal degradation.

d) How does the source spectral width affect the information carrying capacity of a fiber.

e) Compare the spectrum of a Laser Source and an LED source.

f) Define polarization.

g) Draw the diagram to show the effect of waveguide dispersion in single mode fiber.

h) How does quantum noise arise?

i) Mention the noise present in optical receiver.

j) What is meant by quantum limit? Express it mathematically.

SECTION - B

2. Attempt any five questions from this section (5×10=50)

a) i) An optical fiber in air has an NA of 0.4. In that fiber, skew rays which change direction by 100^0 at each reflection. Find out the acceptance angle of skew rays.

ii) Two polarization maintain fibers operating at a wavelength of 1.3 μm have beat lengths of 0.7mm and 80m. Determine the model birefringence in each case.

b) Compare the step index fiber and graded index fiber on their performance parameters.

c) Enumerate the principle of operation of APD.

d) Analyze the light propagation in dielectric slab waveguide.

e) Describe the scheme for realizing the dispersion shifted fiber.

f) How to measure the BER and Q factor in digital transmission.

g) Discuss the waveguide dispersion with relevant mathematical treatment.

h) Derive an expression for the photo current in the case of a homodyne and heterodyne optical receiver systems.

Section - C

Note: Attempt any two Questions from this section. (2×15=30)

3. a) Explain in detail with relevant circuit diagrams the different types of optical pre-amplifiers. **(7)**

b) Discuss the digital link design using the rise time budget. **(8)**

4. a) With a neat diagram, enumerate the different mechanisms that contribute to attenuation in optical fibers. **(12)**

b) A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15km and dispersion is 6.67ns.km^{-1}. Estimate

i) The maximum possible bandwidth on the link

ii) The bandwidth length product for the fiber. **(3)**

5. Elucidate the principle of operation of a Laser diode and derive an expression for the lasing threshold current density. Find the external quantum efficiency for a $Ga_{1-x}Al_xAs$ laser diode (with x=0.03) which has an optical power versus drive current relationship of 0.5 mW/mA. **(15)**

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