

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

Paper ID : 2012425

Roll No.

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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)
- Write down the wavelength regions corresponding to first, second and third windows.
 - 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.
 - List the properties of optical fiber that results in signal degradation.
 - How does the source spectral width affect the information carrying capacity of a fiber.
 - 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° at each reflection. Find out the acceptance angle of skew rays.
- ii) Two polarization maintain fibers operating at a wavelength of $1.3 \mu m$ have beat lengths of 0.7mm and 80m. Determine the modal 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 $0.1 \mu s$ over a distance of 15km and dispersion is $6.67 ns.km^{-1}$. 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 $Ga_{1-x}Al_x$ As 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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