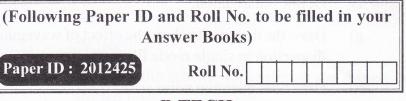
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B.TECH

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. $(10 \times 2=20)$
 - 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 $(5 \times 10 = 50)$

- a) i) An optical fiber in air has an NA of 0.4. In that fiber, skew rays which change direction by 100^o 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)

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- b) A multimode graded index fiber exhibits total pulse broadening of $0.1 \,\mu s$ 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 $Ga_{1-x}A1_x$ Aslaser diode (with x=0.03) which has an optical power versus drive current relationship of 0.5 mW/mA. (15)
