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TEST -2 EXAMINATIONS-2022

B.Tech-VI Semester (ECE)

COURSE CODE: 18B1WEC633

MAX. MARKS: 25

COURSE NAME: Optical Communication Systems

COURSE CREDITS: 03

MAX. TIME: 1 Hour 30 Min

Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1. What is the significance of Maxwell's equations in optical communication system? Derive the equation for plane wave propagation using Maxwell's equations. [5]

Q2. Explain the dispersion phenomenon in optical fiber. What is the criterion to avoid dispersion in optical fiber relating the pulse duration with bit rate? [3]

Q3. Compare the single mode step index, multimode step index and multimode graded index fibers in terms of intermodal dispersion. [3]

Q4. A multimode step index fiber has a numerical aperture of 0.3 and a core refractive index of 1.45. The material dispersion parameter for the fiber is $250 \text{ ps nm}^{-1}\text{km}^{-1}$ which makes material dispersion the totally dominating chromatic dispersion mechanism. Estimate (a) the total rms pulse broadening per kilometer when the fiber is used with an LED source of rms spectral width 50 nm and (b) the corresponding bandwidth-length product for the fiber. [4]

Q.5 Derive the expression for rms pulse broadening due to material dispersion. [4]

Q6. A symmetrical SI planar waveguide is to be excited by a source of central wavelength of $0.85 \mu\text{m}$. Assume that refractive index of core is 1.5 and relative refractive index difference is 0.01. What should be the thickness of the guide layer so that it supports one symmetric and one antisymmetric TE mode? [3]

Q7. Explain [3]
a. Phase velocity and group velocity
b. Propagation parameters k , β and b .
c. Modes in optical fibers.