6E6058

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B. Tech. VI-Sem. (Main/Back) Exam., April/May-2016
Electronics & Communication Engineering
6EC6.3A Optical Fiber Communication

Time: 3 Hours **Maximum Marks: 80**

Min. Passing Marks (Main & Back): 26

Instructions to Candidates:-

*Attempt any **five questions,** selecting **one question** from **each unit.** All Questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly.*

Units of quantities used/ calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

UNIT-I

Q.1 (a) Define the relative refractive index difference for an optical fiber and show how it may be related to the numerical aperture. [8]

(b) An optical fiber has a numerical aperture of 0.20 and cladding refractive index of 1.59. Determine - [8]

(i) The acceptance angle of the fiber in water which has refractive index of 1.33

(ii) The critical angle at core cladding interface

OR

Q.1 (a) Use the ray equation in the paraxial approximation to prove that intermodal dispersion is zero for a graded index fiber with a quadratic index profile. [8]

(b) The photo elastic coefficient and the refractive index for silica are 0.286 and 1.46 respectively. Silica has an isothermal compressibility of 7×10^{-11} $m^2N^{-1}$and an estimated fictive temperature of 1400 k. Determine the theoretical attenuation in decibels per kilometer due to the fundamental Rayleigh scattering in silica at optical wavelengths of 0.85 and 1.55μm. Boltzmann's is 1.381×10^{-23} JK^{-1}. [8]

UNIT-II

Q.2 (a) What is meant by population inversion, optical feedback and threshold level in laser diode? [8]

(b) The longitudinal modes of a gallium arsenide injection laser emitting at a wavelength of 0.87 μm are separated in frequency by 278 GHz. Determine the length of the optical cavity and the number of longitudinal modes emitted. The refractive index of GaAs is 3.6. [8]

OR

Q.2 (a) Outline the advantages and disadvantages of the LED in comparison with the injection laser for use as a source in optical fiber communication. [8]

(b) What techniques are used to create high intensive light pulse from laser diode? [8]

UNIT-III

Q.3 (a) Explain the structure and the working of APD with the help of suitable diagram. Write advantages and disadvantages of APD over PIN diode. [8]

(b) An InGaAs pin photodiode has the following parameters at a wavelength of 1300 nm:

I 2 = 4nA, $\eta = 0.92$, $R_L = 1000\Omega$ and the surface leakage current is negligible. The incident optical power is 300nW (-35 dBm), and the receiver bandwidth is 20 MHz. Find the various noise terms of the receiver. [8]

OR

Q.3 What techniques are used to join two fibers? Explain in brief. Give the principal requirements of a good connector design. [16]

UNIT-IV

Q.4 (a) Write short note on OTDR. [8]

(b) Explain the time domain intermodal and frequency domain intermodal dispersion measurement with the help of experimental set up diagram. [8]

OR

Q.4 (a) Explain "near field scanning technique" for the measurement of mode field diameter (MFD), with the suitable diagram. [8]

(b) Pulse dispersion measurements are taken over 1.2 km length of partially graded multimode fiber. The 2 db widths of the optical pulses are 300 ps, and the corresponding 3db widths for the output pulses are found to be 12.5 ns. Assuming the pulse shapes and fiber impulse response is Gaussian, Calculate: [8]

(i) The 3db pulse broadening for the fiber in ns/km.

(ii) The fiber bandwidth length product.

UNIT-V

Q.5 (a) Give the major reasons which have led to the development of optical amplifiers, outlining the attributes and application areas for these devices.

Describe the two main SOA types and indicate their distinguishing features. [8]

(b) Outline five different optical amplifier configurations to achieve wideband optical amplification. Which is preferred practically and why? [8]

OR

Q.5 (a) Explain WDM in optical fiber. [8]

(b) Write short note on applications of optical fiber. [8]
