Printed Pages : 04 MWE-05

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

PAPER ID : ME14

Roll No. | | | | | | | | | | |

M. TECH. (Sem.II)
THEORY EXAMINATION 2015-16
OPTICAL FIBER COMMUNICATION NETWORK

Time : **3** Hours Total Marks : **100**

Note: Answer all questions.

1. Attempt four parts of the following : 5×4=20

   (a) A graded index fiber with a parabolic refractive index profile core has a refractive index at the core axis of 1.5 and a relative index difference of 1%. Estimate the maximum possible core diameter which allows single-mode operation at a wavelength of 1.3 μm.

   (b) Write a note on non-chromatic and chromatic dispersion.

   (c) A given step-index fiber has a core refractive index of 1.480, a core radius equal to 4.5 μm, and a core-cladding index difference of 0.25 percent. What is the cutoff wavelength for this fiber?

   (d) Write a short note on group delay and modal delay.

   (e) Explains quantum efficiency and LED power with mathematical equations.

2. Attempt any two of the following : 10×2=20

(a) An InGaAs pin photodiode has the following parameters at a wavelength of 1300 nm: I_D=4 nA, η=0.90, R_L=1000Ω, and the surface leakage current is negligible. The incident optical power is 300 nW (-35 dBm), and the receiver bandwidth is 20 MHz. Find the various noise terms of the receiver.

(b) Explains the working of avalanche photodiode with neat diagram. Explains the phenomenon of population inversion with energy level diagram.

(c) Explain six different types of optical connectors, with their use in practical field communication.

3. Attempt any two of the following : 2×10=20

(a) A transmission system sends out information at 200,000 bit/second. During the transmission process, fluctuation noise is added to the signal so that at the decoder output the signal pulses are 1 V in amplitude and the rms noise voltage is 0.2 V.

(i) Assuming that ones and zeros are equally likely to be transmitted, what is the average time in which an error occurs?

(ii) How is this time changed if the voltage amplitude is doubled with the rms noise voltage remaining the same?

(b) Explain the role of analog receivers in optical transmission system, and drive the signal to noise ratio for analog receiver.

(c) What is the dispersion-limited repeater less transmission distance L_{CD} at 1550 nm as a function of the bit rate in a G.652 single mode fiber for the following three cases? Let the chromatic dispersion be D_{CD}= 18 ps/(nm.km) at 1550 nm.

a) A directly modulated laser source with a σ_λ=1.0-nm spectral width

b) A directly modulated laser source with a σ_λ=0.2-nm spectral width

c) An externally modulated single-longitudinal-mode (SLM) DFB laser source with a spectral width that corresponds to the modulation bandwidth.

4. Attempt any two of the following : 2×10=20

(a) Explain the operational principle of WDM with neat diagram and also describe the WDM standards.

(b) What is the Mach-Zehnder interferometer multiplexer? Drive the length difference in the interferometer.

(c) Consider an optical fiber transmission star coupler that has seven inputs and seven outputs. Suppose the coupler is

constructed by arranging the seven fibers in a circular pattern (a ring of six with one in the center) and putting them against the end of a glass rod that serves as the mixing element.

(i) If the fibers have 50-μm core diameters and 125-μm outer cladding diameters, what is the coupling loss resulting from light escaping between the output fiber cores? Let the rod diameter be 300 μm. Assume the fiber cladding is not removed.

(ii) What is the coupling loss if the fiber ends are arranged in a row and a 50-μm×800-μm glass plate is used as the star coupler?

5. Attempt any two of the following : 2×10=20

(a) What is passive optical network (PON)? Draw the basic architecture of basic PON.

(b) Explain

(i) What is active PON network?

(ii) Explain chromatic dispersion compensating fiber?

(c) Explain optical packet and optical burst switching. Consider a commercially available 32×32 single-mode coupler made from a cascade of 3-dB fused-fiber 2×2 couplers, where 5 percent of the power is lost in each element. What are the excess and splitting losses for this coupler?

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