Fiber Optics Communications Topical Objectives

For Exam 2, the student should be able to:

1. Analyze the performance of PIN photodiodes and avalanche photodiodes through calculations of efficiency and responsivity.
2. Calculate total average noise current in a detector circuit to include shot noise, thermal noise, and dark current.
3. Analyze analog receiver performance by calculating signal-to-noise ratio (SNR).
4. Analyze digital receiver performance by calculating bit error rate (BER).
5. Relate receiver BER and Q value to received optical power, detector responsivity, detector circuit current, and noise currents.
6. Analyze the performance of both high impedance and transimpedance amplifiers and be able to select the appropriate type to meet given specifications (bandwidth, noise currents, Q value and BER).
7. Analyze the performance of a point-to-point link with respect to power budget and rise time budget and be able to determine whether a given link design is attenuation-limited or dispersion-limited.
8. Select appropriate components for construction of a point-to-point link to meet both power and rise time budgets.
9. Discuss how the attenuation limit and the dispersion limit for any particular link vary with data rate.
10. Calculate the effect of a passive coupler or series of couplers given the appropriate coupler matrices.
11. Define and calculate splitting ratio, insertion loss, excess loss, and crosstalk for a specified 2x2 coupler.
12. Analyze or design a MUX/DEMUX MZI coupler (consider path length difference and wavelength spacing of adjacent channels).
13. Analyze and discuss design considerations of an NxN coupler constructed with a collection of 2x2 couplers including calculations relating to: the number of couplers required, number of stages, fractional power throughput, excess loss, splitting loss, and total loss.
14. Discuss the design and use of fiber Bragg gratings and their utility in constructing Add-Drop Multiplexers (ADMs).
15. Analyze the performance and effect of doped fiber amplifiers, including considerations of pump power and wavelength, signal power and wavelength, amplifier power conversion efficiency and quantum conversion efficiency, amplifier length, and gain limitations.