

UT-Dallas
EE 6328 — Nonlinear Optics
Spring 2001 — Prof. Cantrell
Assignment 2 (due Feb. 1, 2001)

Reading:

1. Govind Agrawal, *Nonlinear Fiber Optics*, Chapter 3.
2. Professor Cantrell's [overview of digital communications](#) (revised and enlarged)
3. Professor Cantrell's [notes on a simple model of third-order optical nonlinearities](#)
4. Professor Cantrell's and Dr. Hollenbeck's [tutorial on fiberoptic mode functions](#)

Graded Exercises:

1. Agrawal, *Nonlinear Fiber Optics*, Problem 2.4.
2. Agrawal, *Nonlinear Fiber Optics*, Problem 2.6.
3. Agrawal, *Nonlinear Fiber Optics*, Problem 2.10.
4. Agrawal, *Nonlinear Fiber Optics*, Problem 2.11.
5. A hypothetical type of single-mode optical fiber has the following properties at a wavelength $\lambda = 1550$ nm:
 - Attenuation $\alpha = 0.2$ dB/km
 - Chromatic dispersion $D = 10$ ps/nm-km
 - Phase velocity $v = 2 \times 10^8$ m/s

The source is a narrowband laser. The receiver sensitivity and the channel noise are such that the signal-to-noise ratio is too small to be useful if the signal power is attenuated more than 30 dB from its value at the transmitter. Using the information in the lecture slides for Layers 0 and 1, work the following problems:

- (a) Find the maximum transmission distance, L_{\max} , at which there is still a usable signal.
- (b) Using the maximum transmission distance L_{\max} , estimate the maximum bit rate at which a signal can be sent on this type of fiber using on-off keying.

Self-improvement:

1. Govind Agrawal, *Fiber-Optic Communication Systems*, Chapters 3–4.
2. Rajiv Ramaswami and Kumar N. Sivarajan, *Optical Networks: A Practical Perspective*, Chapters 1–3.