NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550/EO 3911 MIDTERM EXAM I 10/01 Prof. Powers

- This exam is closed book and notes; notes on two sides of 8-1/2 x 11 paper are allowed.
- There is a 50 minute time limit.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be *sure* to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.

1	
2	
3	
Total	

Name: _____

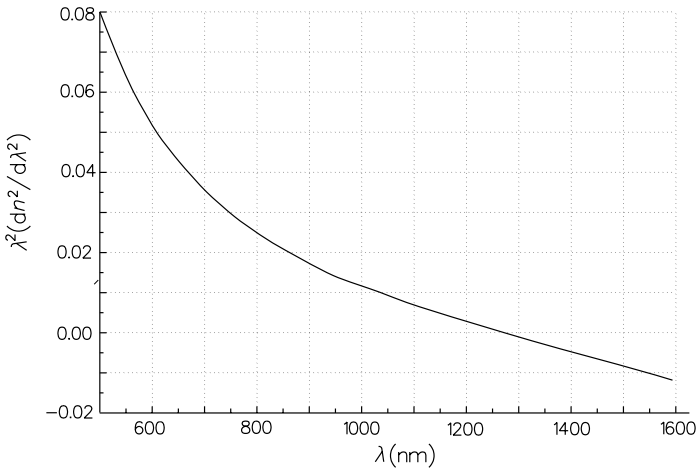

Figure 1: Fig. 3.8 of text

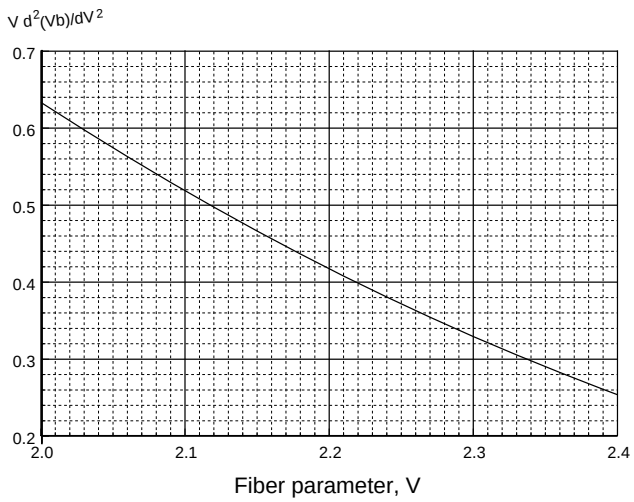

Figure 2: Fig. 3.10 of text

1. (a) What is the primary advantage of a graded-index multimode fiber over a step-index multimode fiber?

   (b) Explain why we want to keep the value of the V-parameter greater than 2.0 when designing a single-mode fiber.

   (c) What is the value of the fiber attenuation, α, if 10% of the input power emerges from a 10-km piece of the fiber?

   (d) An officer asserts that "all definitions of the MFD lead to the same measured value". What is your response?

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2. A 62.5/125 step-index fiber has a core index of 1.460 and a NA of 0.21.

   (a) Sketch the refractive index profile $n(r)$ vs. r. (Be sure to label all of the important points of your graph.)

   (b) Calculate the number of modes in this fiber at $\lambda = 850$ nm.

   (c) Calculate the bit rate-distance product for this fiber if the spectral width of the source is 3 nm at an 850-nm operating wavelength.

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3. Consider a 9/125 step-index, single-mode fiber that is going to operate in 50-km link with 1550-nm source. The core index is 1.460 and the NA is 0.12. The fiber is dispersion shifted and has a value of $Vd^2(Vb)/dV^2 = 0.802$ at $\lambda = 1550$ nm.

   What is the required frequency linewidth of the source, $\Delta\nu$, if the bit-rate of the link is to be 2.5 Gb/s?