

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550

MIDTERM EXAM I

10/99 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: _____

1. It is observed that $50 \mu\text{W}$ in an optical fiber drops to $+15.74 \text{ dB}\mu$ after traversing 2.5 km of fiber. (Assume that there only fiber losses.)

If the input power to the fiber cable is readjusted to $100 \mu\text{W}$ and the only losses are fiber losses, calculate the output power (in *both* $\text{dB}\mu$ and μW) at the end of a 60-km link made of this fiber.

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2. Consider a 10/125 step-index single-mode fiber with a numerical aperture of 0.110, operating at 1550 nm. The bandwidth-distance product of the fiber is $6.9 \text{ GHz}\cdot\text{km}$. Find the maximum spectral linewidth, $\Delta\lambda$, of the source that can be used and still achieve the bandwidth-distance product.

Information added during exam: You need a value of n_1 ; assume $n_1 = 1.460$.

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3. Consider a step-index multimode 50/125 fiber with a core index of 1.46 and $\Delta = 1.5\%$. The wavelength of operation is 1300 nm.
 - (a) Calculate the number of times that the highest-order mode will reflect off of the core-cladding interface in a piece of fiber that is 1 km long.
 - (b) Calculate the total path length traversed by the highest-order mode in a piece of fiber that is 1 km long.

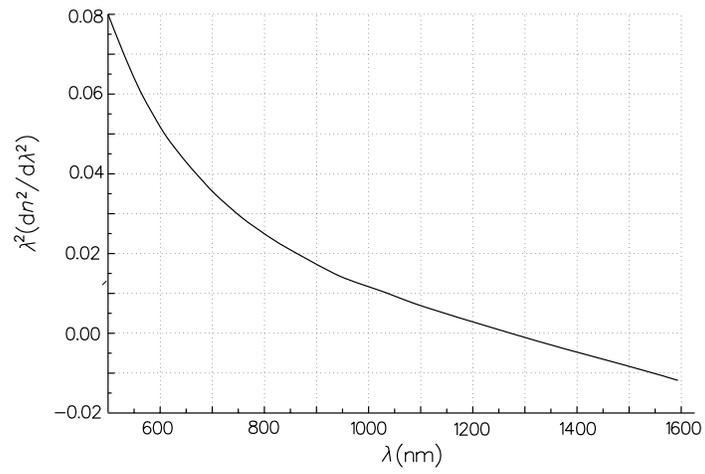


Figure 1: Fig. 3.8 of text

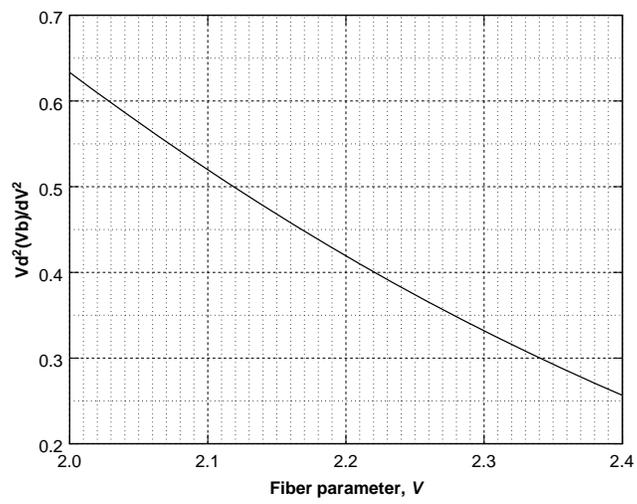


Figure 2: Fig. 3.10 of text