

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550

MIDTERM EXAM II

5/99 Prof. Powers

- This exam is open book and notes.
- 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. Consider a vertical-emitting laser source made of GaAlAs ($n = 3.35$) with a circular active region of $20\text{-}\mu\text{m}$ diameter. The laser has a symmetric beam pattern with a half-angle beam divergence of 33° . The laser light is coupled through a small air gap into a fiber. Calculate the coupling loss (in dB) if this beam is coupled into a $50/125$ step-index fiber with a core index of 1.460 and a fractional difference of refractive index of 1.5% .



2. We want to calculate the total connector losses (in dB) for a PC (“physical contact”) connector that joins a $62.5/125$ graded-index fiber (the emitting fiber) with a profile parameter of 1.94 and numerical aperture of 0.20 to a $50/125$ step-index fiber (the receiving fiber) with a numerical aperture of 0.15 . We will assume that the lateral misalignment is $2.5\ \mu\text{m}$ and that the angular alignment is perfect.



3. Consider the fiber link shown in Figure 1. All components are made of $50/125$ fiber. The excess loss of each splitter is $0.2\ \text{dB}$. The splice losses are $0.2\ \text{dB}$. The fiber losses of the coupler pigtailed are negligible. Each “fiber length” is $8.1\ \text{km}$ long and the fiber attenuation parameter is $0.4\ \text{dB/km}$. We have $100\ \mu\text{W}$ of power in the fiber at point “A” and $50\ \mu\text{W}$ of power in the fiber at point “B”. Calculate the total power (in dBm) in the fiber at point “C”.

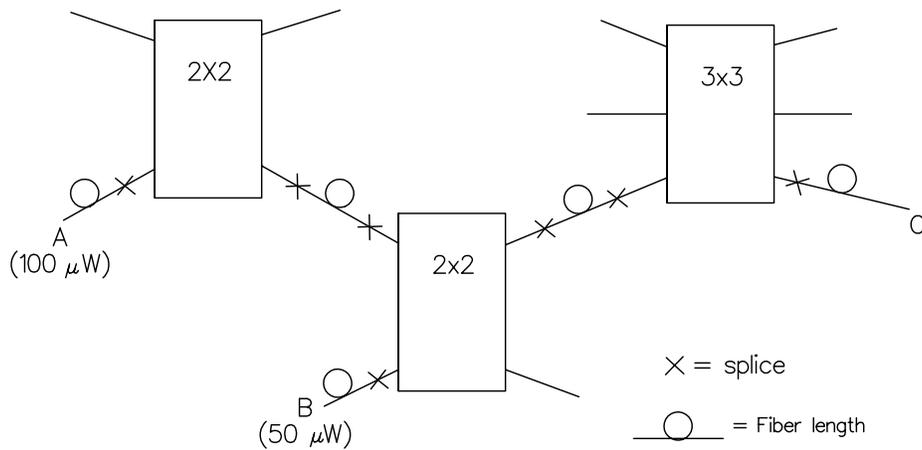


Figure 1: Fiber link for Problem 3.