

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550

MIDTERM EXAM I

5/97 Prof. Powers

- This exam is open book and notes.
- There is a 60 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 100/140 step-index fiber with a core index of 1.45, a fractional index difference of 1.5%, and a length of one km. The operating wavelength is to be 1550 nm.
 - (a) Find the number of modes in the fiber.
 - (b) Consider the highest-order mode in this fiber. Calculate the number of times that it will be reflected at the core-cladding interface as it passes through the 1-km length of the fiber.
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2. Consider a step-index singlemode fiber with a 10 μm core diameter, a core index of 1.450, and $\Delta = 0.30\%$, operating at 1550 nm. Find the maximum linewidth, $\Delta\lambda$, that would be allowed for the source in order to achieve a 10 Gb/s data rate over a 60 km link.
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3. Consider a fiber amplifier designed to use Raman stimulated scattering for a gain effect. The signal gain is to be 1.05 at 1550 nm for a fiber amplifier of 1 km length. The stimulating (“pump”) wave is 150 mW and has a linewidth of 1 nm.
 - (a) Find the wavelength of the stimulating pump source.
 - (b) Find the required mode field diameter of the fiber.