

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3550/EO 3911

MIDTERM EXAM II

11/00 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: _____

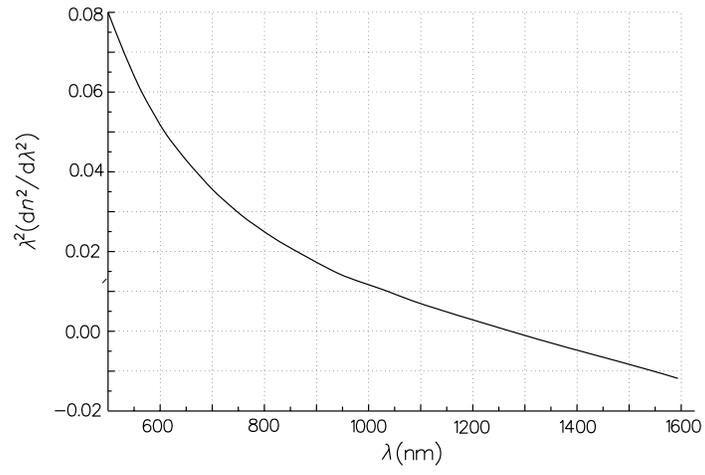


Figure 1: Fig. 3.8 of text

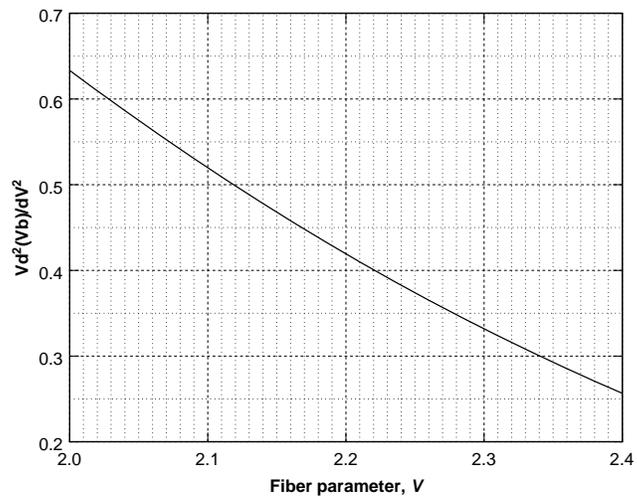


Figure 2: Fig. 3.10 of text

1. (a) List three advantages of a DFB laser over a Fabry-Perot laser.
- (b) Define the "isolation" parameter for an isolator.
- (c) List three applications of an arrayed-waveguide grating (AWG) coupler.
- (d) An officer asserts that "A fiber link that uses an InGaAsP long-wavelength laser will have severe reliability problems because of the poor reliability of these lasers." What is your response?

2. Consider the link shown in Fig. 3. The spectral response of the two AWG devices is shown in Fig. 4 and the reflectivity characteristics of the fiber grating are shown in Fig. 5. The insertion loss and return loss for all splices are 0.5 dB and 40 dB, respectively. The excess loss for the coupler is 0.5 dB. The fiber loss in all of the device pigtails is negligible.

The power, P_{out} , is $1 \mu W$. Using the "dB method", calculate the value of P_{in} , in mW and in dBm .

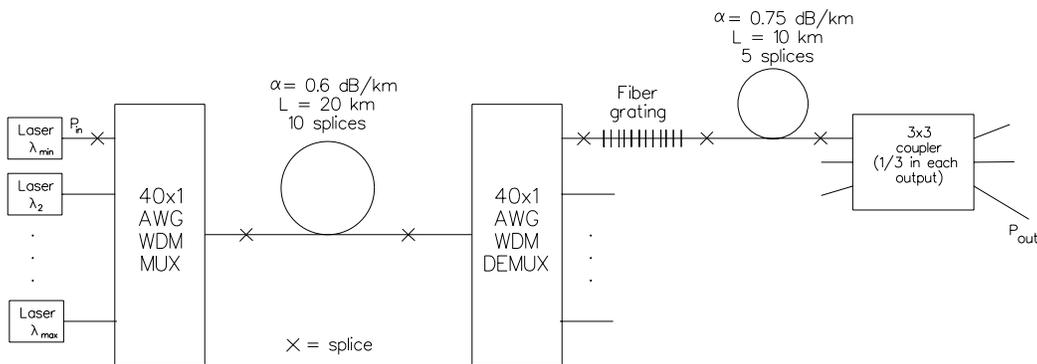


Figure 3: Link of Problem 2.

3. A former NPS student has gone into business making a fusion splicer. His splicer produces zero angular misalignment but, due to a software error in the alignment controller, it laterally misaligns the cores by $1 \mu m$.
 - (a) Calculate the splice loss (in dB) if the splicer is used to splice two pieces of 62.5/125 step-index multimode fiber operating at 1310 nm. The fiber is identical on both sides of the splice with a core index of 1.456 and a Δ of 1.5%.
 - (b) Calculate the splice loss (in dB) if the splicer is used to splice two pieces of 9/125 step-index single-mode fiber operating at 1310 nm. The fiber is identical on both sides of the splice with a mode-field diameter of $9.4 \mu m$ at 1310 nm, a core index of 1.456, and a Δ of 0.4%.

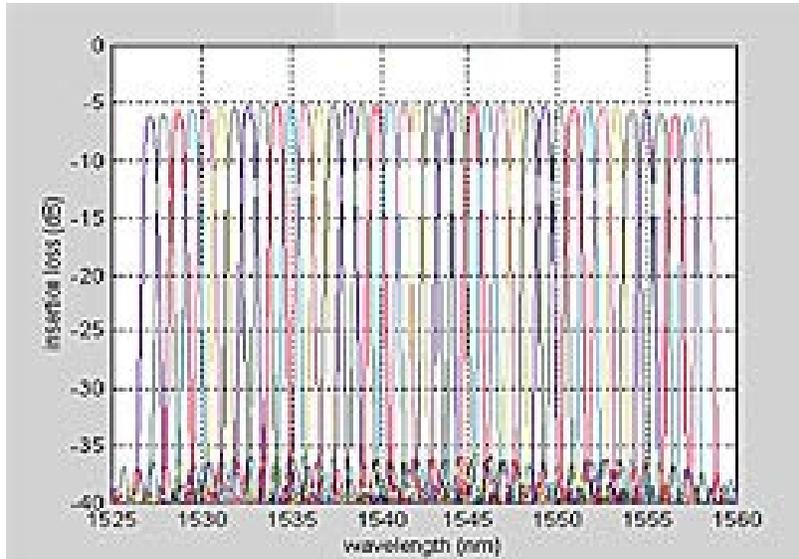


Figure 4: Spectral response of AWG coupler.

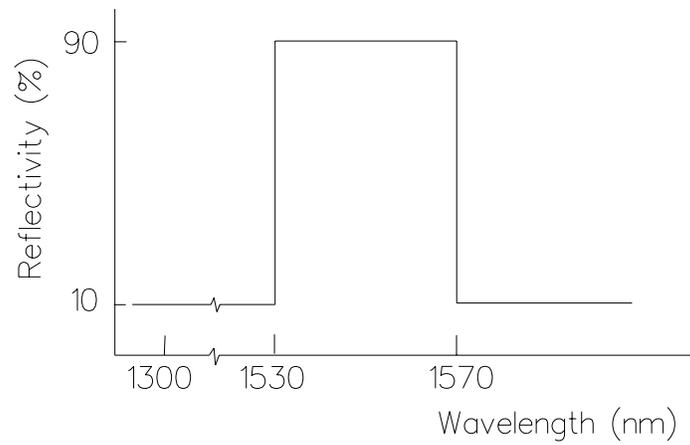


Figure 5: Reflectivity (idealized) vs. wavelength for fiber grating of Problem 3.