

3.46 PHOTONIC MATERIALS AND DEVICES

Homework Assignment 2—February 15, 2006

Due: February 22, 2006

1. a) Construct a 3-D Materials Property Design Diagram for the Energy Gap of Group IV, II-V, II-VI and IV-VI compounds. Plot [the average principal quantum number (x)] vs. [electronegativity difference (y)] vs. [energy gap (z)]. Use room temperature E_g values and Pauling electronegativity values.

b) Derive an alloy Design Rule from the diagram.

2. Consider a 100 km long fiber optic link. You have a $\lambda = 1.55 \mu\text{m}$ laser light source with linewidth $\Delta\nu = 100 \text{ GHz}$, and the material dispersion coefficient at this wavelength is $D_\lambda = 20 \text{ ps/km/nm}$. What is the maximum data rate (in Gbit/s) you can encode on the $\lambda = 1.55 \mu\text{m}$ carrier channel?

3. Give the expressions that define the bit rate dependence of the loss limit and the dispersion limit of an optical fiber interconnect.