ECEN 466
Final Exam
Fall 2009
Prof. Stephen Schultz – 422-1693

Name: _____

Instructions – Please Read

1. Closed book and closed notes
2. 3 hour time limit
3. This exam consists of:
   a. 6 shorter questions (worth 10 points each).
   b. 2 work out problems (worth 20 points each). Be sure to explain you process and box your answer.

Appendix

Wavelength: $\lambda = \frac{c}{f}$

Wavelength emission for a semiconductor: $\lambda = \frac{1.24}{E_g}\ \mu m$, where E_g is in eV

Numerical Aperture: $NA = \sqrt{n_1^2 - n_2^2}$

Normalized Frequency: $V = \frac{2\pi}{\lambda} a \sqrt{n_1^2 - n_2^2}$

Refractive index different: $\Delta = \frac{n_1 - n_2}{n_1}$

Cut-off V-parameter for low-order LP_{lm} modes

	m=1	**m=2**	**m=3**
l=0	0	3.832	7.016
l=1	2.405	5.520	8.654
l=2	5.1356	8.4172	11.6198

Approximate electric field profile for the LP_{01} mode: $E = E_o \exp\left(-\frac{4\rho^2}{MFD^2}\right)\exp(j\beta z)$,

where MFD is the mode field diameter

α_{dB} (dB/km) = 4.34 α (km^{-1})

Rayleigh scattering: $\alpha_R = c_R \frac{1}{\lambda^4}$

Intermodal dispersion for step index optical fiber: $D_{inter} = \frac{n_{1g}}{c}\frac{\Delta}{2}$

Intermodal dispersion for a graded index optical fiber: $D_{inter} = \frac{n_{1g}}{c}\frac{\Delta^2}{4}$

Laser linewidth due to modulation: $\Delta f = 2B$, where B is the bit rate

$P_{min}(B) = P_{min}(B_o) + 10\log_{10}(B/B_o)$

Dispersion limited length: $L < \frac{1}{4\, D_{tot}\, B}$