Problem Set 1:

A- Do the following problems in the text book: 2.2 and 2.4

B- Assuming the relative refractive index difference is one percent and n1=1.5, using Matlab plot the bit rate-distance product due to intermodal dispersion for a step-index and graded-index fiber from zero to 50 km. You may want to show your results on log scale. Make sure you show your graph and code.

C- Assuming a SONET system operates at 2.5 Gbps, calculate the longest span this system can support due to intermodal dispersion for both multimode step-index and graded-index fibers. You can use your results from the previous problem.

D- Assuming the dispersion length of a fiber a connected to a 2.5 Gbps SONET system is determined to be 1800 km and the system operates at 1.55 micro-meter, answer the following questions:

1. Assuming the source generates an unchirped Gaussian Pulse, plot the width of the pulse as it travels over a 3600 km span.
2. Repeat part 1, assuming the chirp factor is -3.
3. Compare the results in parts 1 and 2 and make your conclusions.

E- Consider an 8-km fiber operating at 1.3 micro-meter. Assume the input power is 120 micro-watt and the output power is only 3 micro-watt.

1. Calculate the total attenuation throughout this system (in dB).
2. Calculate how much of this attenuation is due to Rayleigh scattering (in dB).
3. Assuming we increase the length of the fiber to 10 km, calculate the percentage increase of the total loss and percentage increase of Rayleigh scattering.
4. Is the loss increase linear? Elaborate on your answer.

F- Consider a single mode fiber with a core refractive index of 1.5, and relative refractive index difference of 0.3% and an operating wavelength of 1.55 micro-meter. Assume the core diameter is 8 micro-meter. Using Matlab plot the critical radius of the curvature for this fiber operating in Short band. Show your code.

G- Using a table explain what happens to the following parameters as we increase the operating wavelength in Original band (assume everything else stays the same). In each case make a brief comment.

|  |  |  |
| --- | --- | --- |
| Parameter | Impact (by what factor?) | Comment (good or bad) |
| Core Diameter for single mode fiber |  |  |
| Loss due to Rayleigh Scattering  |  |  |
| SBS  |  |  |
| Bent loss |  |  |