The University Of Texas at Dallas

Physical Optics

EE 6317

Summer 2008
Assignment 2

Due Date:

June 11, 2008

Reading:

Eugene Hecht, *Optics*, Fourth Edition, Chapters 7 and 8

Reference Material:

Dr. Cantrell's notes on time-domain and frequency-domain analysis of transmission lines

Dr. Cantrell's slides on interference

Problems:

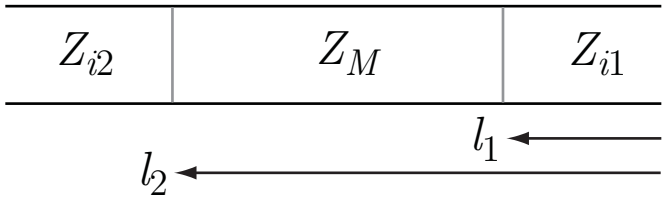
Please write your answers to the following problems on engineering paper. No credit will be given for work handed in on other types of paper.

1. In lecture, it was shown that, for a sinusoidally driven transmission line,

$$Z_i(-l_2)Z_i(-l_1) = Z_M^2 \ , \tag{1}$$

provided that

$$l_2 = l_1 + \lambda/4 \ .$$



(a) Show how to use Eq. (1) to design the characteristic impedance Z_M of a matching section of transmission line that is inserted between transmission lines with characteristic impedances Z_1 and Z_2, such that the reflection coefficient of a wave incident from the left is zero.

(b) Express Eq. (1) in a form that is suitable for a plane, monochromatic electromagnetic wave incident normally on the interface between a dielectric with permittivity ϵ_1 and a dielectric with permittivity ϵ_2.

(c) Further transform Eq. (1) into a form that is suitable for a plane, monochromatic light wave incident normally on the interface between a medium with refractive index n_1 and a medium with refractive index n_2.

(d) Use your results to design the refractive index of an antireflection coating at a wavelength such that $n_1 = 1.00$ and $n_2 = 1.50$.

2. This problem pertains to Young's two-slit interference experiment, in which the distance between the slit centers is $d = 1$ mm, the slit-to-screen distance is $D = 1$ m, and the wavelength is $\lambda = 633$ nm. Find the spacing between adjacent interference fringes on the screen.