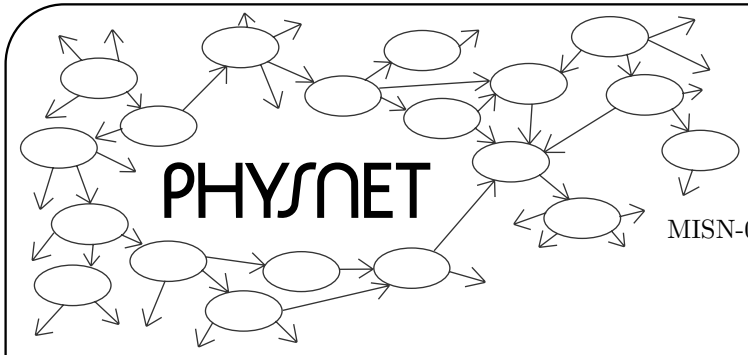

MISN-0-514

ELECTROMAGNETIC WAVES

Electricity and Magnetism

Project PHYSNET Physics Bldg. Michigan State University East Lansing, MI

ELECTROMAGNETIC WAVES

by

R. Young

Title: **Electromagnetic Waves**

Author: R.D. Young, Dept. of Physics, Ill. State Univ

Version: 2/1/2000 Evaluation: Stage B0

Length: 2 hr; 7 pages

Input Skills:

1. Vocabulary: phase velocity, amplitude (MISN-0-201); homogeneous wave equation (MISN-0-513); Fourier series (MISN-0-482).
2. State Maxwell's equations and the boundary conditions that must be satisfied by their solutions. (MISN-0-513).
3. Determine the Poynting vector for an electromagnetic field (MISN-0-513).
4. Express complex quantities in cartesian and polar form.

Output Skills (Knowledge):

K1. Vocabulary: skin depth, critical angle, Brewster's angle, total internal reflection.

K2. Derive the expressions for the electric and magnetic fields associated with a monochromatic plane wave propagating in: (i) a non-conducting medium; and (ii) a conducting medium.

K3. Derive the reflectance and the transmittance of a monochromatic plane wave normally incident on an interface between two dielectrics.

K4. Derive the reflectance and the transmittance for both polarizations of a monochromatic plane wave obliquely incident on an interface between two dielectrics.

Output Skills (Problem Solving):

S1. Determine the reflection and transmission coefficients of a wave incident on an interface when one medium is a conductor or when the angle of incidence exceeds the critical angle.

External Resources (Required):

1. J. Reitz, F. Milford and R. Christy, *Foundations of Electromagnetic Theory*, 4th Edition, Addison-Wesley (1993).

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1. Introduction

In this unit you will use Maxwell's equations to solve certain types of boundary value problems involving the propagation of electromagnetic waves. The specific problems involve the reflection and transmission of electromagnetic waves incident normally and obliquely on an interface between two media. In addition, the propagation of monochromatic plane electromagnetic waves in conducting media will be treated.

2. Procedures

1. Read Sections 17-1 and 17-4 of the text.

2. Read Section 18-1 through 18-5 of the text.

3. Solve these problems: 18-11, 18-13, 18-14.

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