EE - 3140
Electromagnetics

Curricular Designation:  EE: required     CpE: elective

Catalog Description:
EE 3140 - Electromagnetics Covers basic principles of engineering electromagnetics with an emphasis on Maxwell's equations. Credits: 3.0 Lec-Rec-Lab: (3-0-0) Semesters Offered: Fall, Spring
Pre-Requisite(s): PH 2200 and MA 3160 and (EE 2110 or EE 2112)

Textbooks(s) and/or Other Required Materials:
1. Applied Electromagnetism, Third Edition, Liang Shen, and Jin Au Kong, PWS,

Prerequisites by Topic:
1. Familiarity with Euler’s identity and complex numbers, vectors and vector operators grad, divergence and curl.

2. Introduction to electromagnetic field concepts relating to current and voltage.

Course Objectives:
1. Mastery of:
   a. Characteristics of plane waves, their direction of propagation, wavelength, frequency, vector direction including polarization.
   b. Boundary conditions of electric and magnetic fields at interfaces

2. Familiarity with:
   a. Application of Maxwell's equation to reflection at dielectric and metallic interfaces.
   b. Dispersion and loss in complex media.
   c. Transmission lines and properties of VSWR and matching.

3. Introduction to:
   a. Antenna principles such as polarization of the radiated electromagnetic field.
   b. Properties of the electric dipole and resonance at one-half wavelength.
   c. Identification of modes in waveguides.
   d. Principles of Rayleigh scattering and Doppler shift.

Topics Covered:
1. Complex Vectors
2. Maxwell's Equations
3. Uniform Plane Waves
4. Reflection and Transmission of Waves
5. Waveguides and Resonators  
6. Transmission Lines  
7. Antennas  
8. Topics in Waves

**Relationship of the Course Content to Program Outcomes:**

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<tr>
<th>Outcome</th>
<th>Topics and Level of Coverage</th>
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<tr>
<td></td>
<td>Important</td>
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<tr>
<td>a  an ability to apply knowledge of mathematics, science and engineering</td>
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<td>b  an ability to design and conduct experiments, as well as to analyze and interpret data</td>
<td>Moderate</td>
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<td>c  an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, health and safety, manufacturability and sustainability</td>
<td>Minimally</td>
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<td>d  an ability to function on multi-disciplinary teams</td>
<td>Important</td>
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<td>e  an ability to identify, formulate and solve engineering problems</td>
<td>Important</td>
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<td>f  an understanding of professional and ethical responsibility</td>
<td>Important</td>
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<td>g  an ability to communicate effectively</td>
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<td>h  the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
<td>Important</td>
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<td>i  a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>j  a knowledge of contemporary issues</td>
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<td>k  the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
<td>Important</td>
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**Contribution of Course to Meeting Degree Requirements:**

1 Credit Hour – Math/Basic Science  2 Credit Hours - Engineering Topics

**Class/Laboratory Schedule** (note: 1 hour = 50 minutes):
Lecture: 42 hours = 3 hours/week for 14 weeks

**Prepared by:**
Durdu Guney, Associate Professor, January 14, 2017