Electromagnetic Field Theory

Catalog: Electrodynamics; Laplace’s Equation; the theory of dielectrics; magnetostatics; electromagnetic induction; magnetic fields of currents; Maxwell’s equations. Credit for both ENPH 332 and PHYS 332 will not be awarded.

Hours: 3 hours (3 lecture/0 lab)

Prerequisites: University Physics II; Differential Equations or Calculus III (Co-requisite)

Campus Numberings:

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COURSE LEARNING OBJECTIVES:

### Course Goals
Upon completion of this course, students will

1. know Coulomb’s law and be able to use it to solve for the electrostatic force applied upon a point charge by a collection of other point charges.

2. know the definitions of standard terms in electromagnetism including electric potential, electric field, magnetic field, magnetic vector potential, induction, capacitance, etc.

3. know the formula for the electric field due to an infinitesimal point charge and be able to use it to calculate the electric field due to either a collection of discrete point charges or a continuous surface, line or volume charge density.

4. know the formula for the electric potential due to an infinitesimal point charge and be able to use it to calculate the electric potential due to either a collection of discrete point charges or a continuous surface, line or volume charge density.

5. be able to find the electric field at a point in space given the electric potential

6. be able to apply Gauss’ Law to solve for the electric field in an electrostatic problem that involves a high degree of symmetry.

7. be able to apply various solution techniques including the method of images, separation of variables, and multipole expansions to solve Poisson’s and Laplace’s Equations.

8. know the meaning of polarization, displacement vector, and dielectric constant and be able to use these concepts to solve problems involving dielectric media.

9. be able to determine the magnetic field created by either a line, area, or volume current density.

10. be able to write Maxwell’s equations in both integral and differential form.
11. be able to show that the solution to Maxwell’s equations for time-varying fields in free space are electromagnetic waves with the speed c.  

12. be able to apply mathematical techniques necessary to solve E&M problems including the application of vectors, vector and integral  

| Embedded Course Assessment |