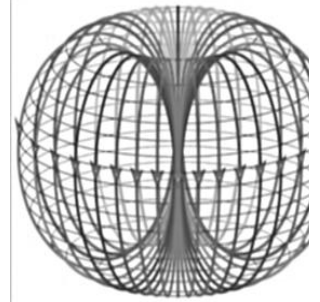


# 19EE203 ELECTROMAGNETIC FIELDS

Hours Per Week :

L	T	P	C
3	1	-	4



Source :  
<https://www.shutterstock.com/image-vector/electromagnetic-field-317573744>

## COURSE DESCRIPTION AND OBJECTIVES:

This course offers the fundamental knowledge of electromagnetic fields involved in various electrical engineering applications. It introduces cartesian, cylindrical and spherical coordinate systems for electromagnetic fields along with the concepts of electrostatics and dynamics for wave propagation in transmission lines and free space. The objective of course is to describe and analyze the facts behind the propagation of signals through transmission lines and free space.

## COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Understand the mathematical concepts of coordinate systems and vector calculus.
2	Apply fundamental laws of fields to static electric fields in different engineering applications.
3	Solve engineering problems related to conductors, dielectrics, capacitance, electric and magnetic fields.
4	Apply fundamental laws to static magnetic fields and magnetic forces.
5	Apply the Maxwell's equations to static and time varying fields.

## SKILLS:

- ü Classify the materials as linear, isotropic and homogeneous.
- ü Draw the magnetic flux patterns for various magnetic sources.
- ü Determine electromagnetic field intensities for various kinds of sources in different media.
- ü Apply the Maxwell's equations to static and time varying fields.

**UNIT - I****L - 9, T - 3**

**REVIEW OF VECTOR CALCULUS:** Vector algebra-addition, Subtraction, Components of vectors, Scalar and vector multiplications, Triple products, Three orthogonal coordinate systems (rectangular, cylindrical and spherical); Vector calculus differentiation, Partial differentiation, Integration, Vector operator del, Gradient, Divergence and curl; Integral theorems of vectors; Conversion of a vector from one coordinate system to another.

**UNIT - II****L - 9, T - 3**

**STATIC ELECTRIC FIELD:** Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions; Gauss law and its applications; Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations; Electric dipole, Electrostatic Energy and Energy density.

**UNIT - III****L - 9, T - 3**

**CONDUCTORS, DIELECTRICS AND CAPACITANCE:** Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials; Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

**UNIT - IV****L - 9, T - 3**

**STATIC MAGNETIC FIELDS:** Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials; Steady magnetic fields produced by current carrying conductors.

**MAGNETIC FORCES:** Force on a moving charge, Force on a differential current element, Force between differential current elements.

**UNIT - V****L - 9, T - 3**

**MATERIALS AND INDUCTANCE:** Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

**TIME VARYING FIELDS AND MAXWELL'S EQUATIONS:** Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces; Boundary conditions.

**TEXT BOOKS:**

1. M. N. O. Sadiku, "Elements of Electromagnetics", 6<sup>th</sup> edition, Oxford University Press Inc., 2015.
2. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

**REFERENCE BOOKS:**

1. William H. Hayat and J. A. Buck, 'Engineering Electromagnetics', 7<sup>th</sup> edition, Tata Mc Graw Hill, 2014.
2. John Kraus and D. Fleish, 'Electromagnetics with Applications', 5<sup>th</sup> edition, Mc Graw Hill International Editions, 2010.