

# ELECTROMAGNETICS

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## *Course Instructor*

### **Dr. Muhammad Anisuzzaman Talukder**

Professor

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## *Course Website*

Please check

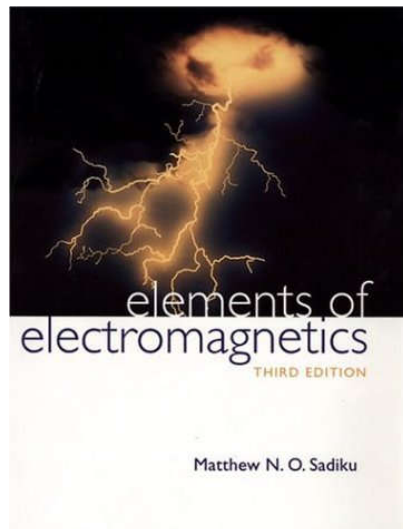
<https://anis.buet.ac.bd/EM.html>

for lectures, grades, and updates.

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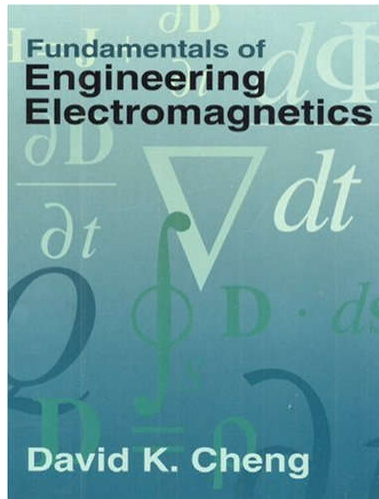
## *Text Book*



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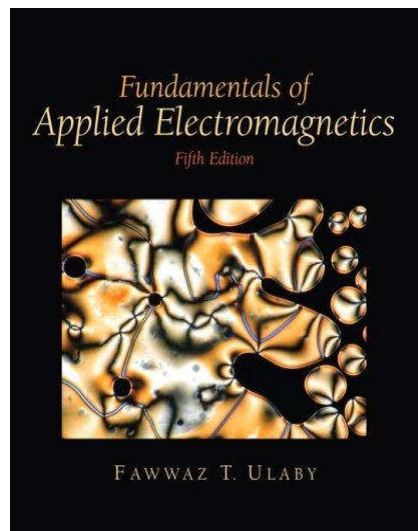
## *Text Book*



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## *Reference Book*



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## *Electromagnetics (EM)*

EM is a branch of physics or electrical engineering in which electric and magnetic phenomena are studied.

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## *Course Overview*

**Electrostatics** → originates from stationary charges

**Magnetostatics** → originates from steady currents

*Electric and magnetic fields are uncoupled.*

**Electromagnetic Waves** → originates from time-varying sources

*Electric and magnetic fields are coupled.*

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## *Course Overview*

### **Electrostatics**

Postulates of electromagnetics, Coulomb's law for discrete and continuously distributed charges, Gauss's law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density – boundary conditions, capacitance – electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries, boundary value problems – Poisson's and Laplace's equations in different coordinate systems.

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## *Course Overview*

### **Magnetostatics**

Postulates of magnetostatics, Biot-Savart's law, Ampere's law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries.

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## *Course Overview*

### **Electromagnetic Waves**

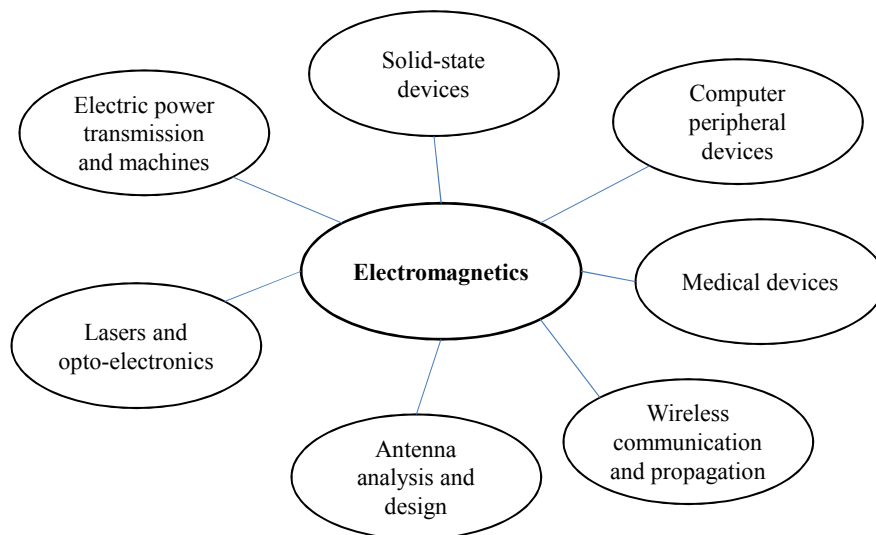
Faraday's law of electromagnetic induction, Maxwell's equations – differential and integral forms, boundary conditions, potential functions, time harmonic fields and Poynting theorem.

Plane wave in lossless media, Doppler effect, transverse electromagnetic wave, polarization of plane wave, plane wave in lossy media – low-loss dielectrics, good conductors, group velocity, instantaneous and average power densities, normal and oblique incidence of plane waves at plane boundaries for different polarization.

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## *Why study electromagnetics?*



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## *Time Line*

- Week 1:** Introduction to Electromagnetics, Vector Algebra, Coordinate Systems and Transformation, Vector Calculus
- Week 2:** Electrostatic Fields
- Week 3:** Electrostatic Fields
- Week 4:** Electrostatic Fields in Material Space
- Week 5:** Electrostatic Boundary-Value Problems
- Week 6:** Magnetic Fields
- Week 7:** Magnetic Forces, Materials, and Devices
- Week 8:** Magnetic Forces, Materials, and Devices
- Week 9:** Maxwell's Equations
- Week 10:** Maxwell's Equations
- Week 11:** Electromagnetic Wave Propagation
- Week 12:** Electromagnetic Wave Propagation
- Week 13:** Review
- Week 14:** Review

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## *Class Tests*

- **Electrostatics – 1**
- **Magnetostatics – 1**
- **Electromagnetic Waves – 1**

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## *First Assignment*

- Email to [anis@eee.buet.ac.bd](mailto:anis@eee.buet.ac.bd) with
  - **Subject:** Electromagnetics
  - **Body:** “Your Name, Student Number” <email address>
- It will help me to keep you posted on the course updates.

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