Engineering Electromagnetics
25733
Winter-Spring 2014
Sharif University of Technology

INSTRUCTOR: Amir Borji, Room 211 (Ext. 4381, Email: aborji@sharif.edu)

SCHEDULE: **Lectures: Sat/Mon 9:00-10:30 in Bargh 7. Tutorials: TBA**

CLASS WEBSITE: **http://sharif.edu/~aborji/25733/**

TEXT and REFERENCES:

1 - ***Field and Wave Electromagnetics*, 2nd Ed., D. K. Cheng, 1989, Addison-Wesley Inc.**

2 - ***Engineering Electromagnetics***, U. S. Inan and A. S. Inan, 1999, Addison-Wesley Inc.

3 - *Electromagnetics*, B. M. Notaros, 2011, Prentice-Hall Inc.

4 - ***Introduction to Electrodynamics***, 4th Ed., D. J. Griffiths, 2013, Prentice-Hall Inc.

5 - *Electricity and Magnetism*, 3rd Ed., E. M. Purcell and D. J. Morin, 2013, Cambridge Univ. Press

"TENTATIVE" COURSE OUTLINE (based on Cheng's book):

Chapter 2 : Review of Vector Analysis and Coordinate Systems (~3 lectures)

- ◊ Cartesian (rectangular), cylindrical, and spherical coordinates
- ◊ Vector algebra and vector fields
- ◊ Coordinate transformations
- ◊ Curl, divergence, and gradient
- ◊ Stokes and Gauss' theorems, Green's theorem

Chapter 3 : Fundamentals of Electrostatics (~8 lectures)

- ◊ Basic concepts: point, surface, and volume charges
- ◊ Coulomb's law, electric dipole
- ◊ Electric field lines, displacement and flux, flux density
- ◊ Gauss' law and its applications
- ◊ Electric potential, curl of the electric field, KVL
- ◊ Conductors in electrostatic field
- ◊ Capacitance
- ◊ Multiple conductors and mutual capacitance, (*) Green's reciprocity theorem
- ◊ Dielectrics in electrostatic field, polarization, permittivity, boundary conditions
- ◊ Energy stored in electrostatic field, forces on dielectrics and conductors

Chapter 4 : Special Techniques for Calculation of Electrostatic Fields (~3 lectures)

- ◊ Fundamental equations: Laplace and Poisson equations
- ◊ Uniqueness of solutions
- ◊ Theory of images
- ◊ Solution of Laplace equation in simple cases

Midterm exam : 1393/2/11

Chapter 5 : Steady Electric Current (~2 lectures)

- ◊ Steady electric current, current density, boundary conditions

- ◊ Conservation of charge, continuity equation, KCL
- ◊ Ohm's law
- ◊ Resistance and resistors
- ◊ Joule's law

Chapter 6 : Fundamentals of Magnetostatics (~8 lectures)

- ◊ Lorentz force law, moving charges and currents, magnetic fields
- ◊ Biot-Savart law and its applications
- ◊ Magnetic flux and lines of force
- ◊ Ampere's circuital law and its applications
- ◊ Vector and scalar magnetic potentials, magnetic dipole
- ◊ Magnetic fields in material media: magnetization, boundary conditions
- ◊ Ferromagnetism, Paramagnetism, Diamagnetism
- ◊ Inductance and inductors
- ◊ Mutual inductance
- ◊ Energy stored in magnetic field, magnetic forces and torques
- ◊ Magnetic circuits

Chapter 7 : Time Varying Electromagnetic Fields (~4 lectures) (Sec: 1,2,3,5,6,7)

- ◊ Faraday's law, electromotive force
- ◊ Generalized Ampere's law, displacement current
- ◊ Maxwell's equations, wave equation,
- ◊ Solution of the wave equation, reflection and transmission of wave at a dielectric interface

GRADING POLICY:

Mid-term exam: 40-50%
Final exam: 40-50%
Homework, quizzes, attendance: 10%-15%

There will be a short quiz at the end of each lecture covering the material that was presented in the previous lecture.
Students are not allowed in class 15 minutes after the lecture starts (when the door is closed)
If you miss 6 lectures, you fail the course (zero mark) with no exception. Your exam marks will not be considered.