Bangladesh University of Engineering and Technology
Department of Electrical and Electronic Engineering
EEE 209 (Engineering Electromagnetics) for L-2/T-II Students

COURSE TEACHERS: Section A: Dr. Pran Kanai Saha (Email: sahapk@eee.buet.ac.bd)
Section B: Dr. Md. Shah Alam (Email: shalam @eee.buet.ac.bd)
Section C: Dr. Mahbub Alam (Email: mahbubalam@eee.buet.ac.bd)

COURSE OBJECTIVE: Most applications in electrical engineering rely on electromagnetic effects. This course aims to bring an understanding of the physical principles and characteristics of electromagnetic devices in electrical and electronic engineering. Fundamental scientific knowledge in the form of Maxwell's equations is covered in detail to build a platform for discussions concerning many practical applications which exploit electromechanical energy conversion and electromagnetic waves. The course covers electrostatics, magnetostatics, steady current, time-varying electromagnetics, Maxwell equations with applications and electromagnetic wave propagation characteristics.

COURSE OUTCOME:

- Use Coulomb's, Gauss's, Ampere's and Faraday's Laws in the context of electrical devices
- Design capacitors & inductors and analyze their characteristics
- Solve simple boundary value problems, using the method of images and Poisson's equation.
- Calculate the forces that develop in electromagnetic actuators used in energy conversion and energy storage devices
- Describe the engineering uses of electromagnetic waves, and propagation characteristics in different media
- Concept of electric dipole and magnetic Dipole (loop antenna)
- Distinguish between materials, based on their electromagnetic properties
- Polarization of plane wave and EM power flow

BOOKS: (1) "Principles of Electromagnetics", by M. N.O. Sadiku

(2) "Fundamentals of Engineering Electromagnetics" by David K. Cheng

LECTURE PLAN:

Topics	Week
Introduction: Electromagnetics, Why EM, Applications, Fields, EM Source, Electrical quantities, Electrostatics: Fundamental postulates of static Electric field, Coulomb's law	1
Gauss law and applications, Electric potentials , material media in Electric field, Electric flux density, dielectric strength, boundary conditions for Electrostatics, Electric dipole	2-3
Capacitances, Electrostatics energy, Boundary value problem, Poisson's and Laplace equation, Image theory	4
Steady Electric currents: Current density and ohm's law, equation of continuity, Power dissipation and Joules law, Governing equations for steady current and boundary conditions	5
Magnetostatics: Fundamental postulates of magnetostatics, Vector magnetic potentials, Biot-savart law, magnetic dipole, magnetic field intensity and permeability, magnetic materials,	6-7

boundary conditions, Inductances, magnetic stored energy, magnetic force and torque	
Time varying Fields and Maxwell's equation: Faraday's law of EM induction, Maxwell's equations (differential, integral and phasor form), Potentials functions, Time harmonics fields, Helmholtz's wave equations	8-9
Plane waves in lossless media, Doppler effect, TEM wave, Polarization of plane waves, plane wave in lossy media, lowloss dielectric, good conductors, Phase velocity and group velocity, EM power flow and Poynting vector, Instantaneous EM power in a good conductor and lossy dielectric, Normal incidence of plane wave at plane boundaries	10-12
Review	13

CLASS SCHEDULE:

Section	Day	Room No.	Time
A	Saturday	ECE R236	8:00 AM-8:50 AM
	Sunday	ECE R236	8:00 AM- 8:50 AM
	Wednesday	ECE R236	12:00 PM- 12:50 PM
B	Saturday	ECE R918	9:00 AM- 9:50 AM
	Monday	ECE R918	9:00 AM- 9:50 AM
	Wednesday	ECE R918	11:00 AM- 11:50 AM
C	Sunday	ECE R920	11:00 AM- 11:50 AM
	Monday	ECE R920	10:00 AM- 10:50 AM
	Tuesday	ECE R920	11:00 AM- 11:50 AM

CLASS TESTS/ASSIGNMENTS Policy: Four class tests will be taken. No make-up class test will be considered. Out of four class tests, best three will be counted. All assignments have to be submitted in time and should be submitted in written form. No print form of the assignment will be marked.

ATTENDENCE: No attendance will be given for late comers.

MARKS DISTRIBUTIONS:

Attendance and participation:	10%
Class Tests/Assignments:	20%
Final Exam:	70%
Total:	100%