

EITF80 Electromagnetic Fields (E), HT, updated 2023-08-24

Lecture Plan

References are made to relevant sections of the course textbook "Field and Wave Electromagnetics" (by David. K. Cheng).

Study Period 1 (HT1)

Lecture 1

Introduction, Coulomb's Law, electric potential

Cheng 1.1, 3.3, 3.5

Lecture 2

Vector addition and subtraction, products of vectors, orthogonal coordinate systems

Cheng 2.2-2.4

Lecture 3

Integrals containing vector functions, gradient of a scalar field

Cheng 2.5, 2.6

Lecture 4

Divergence of a vector field, Divergence Theorem

Cheng 2.7, 2.8

Lecture 5

Curl of a vector field, Stoke's Theorem, two null identities

Cheng 2.9-2.11

Lecture 6

Coulomb's Law (cont.), Gauss' Law and application, electric potential (cont.)

Cheng 3.3, 3.4, 3.5

Lecture 7

Conductors and dielectrics in static electric field, electric flux density and dielectric constant

Cheng 3.6, 3.7, 3.8

Lecture 8

Boundary conditions for electrostatic fields, capacitance and capacitors

Cheng 3.9, 3.10

Study Period 2 (HT2)

Lecture 9

Capacitance and capacitors (cont.), method of images

Cheng 3.10, 4.4

Lecture 10

Current densities and Ohm's Law

Cheng 5.2

Lecture 11

Equation of continuity and Kirchhoff's Current Law, power dissipation and Joule's Law

Cheng 5.4, 5.5

Lecture 12

Biot-Savart Law and application, relation to magnetic force

Cheng 6.1, 6.4

Lecture 13

Ampere's Circuital Law, vector magnetic potential, the magnetic dipole

Cheng 6.2, 6.3, 6.5

Lecture 14

Magnetization and equivalent current densities magnetic field intensity and relative permeability, behavior of magnetic materials

Cheng 6.6, 6.7, 6.9

Lecture 15

Boundary conditions for magnetostatic fields, magnetic circuits

Cheng 6.8, 6.10

Lecture 16

Self and mutual inductances, magnetic forces and torques

Cheng 6.11, 6.13 (excl. 6.13.3-6.13.4)

Lecture 17

Magnetic forces and torques (cont.), electromagnetic induction

Cheng 6.13 (excl. 6.13.3-6.13.4), 7.1, 7.2 (excl. 7.2.2)

Lecture 18

Maxwell's Equations, potential functions, wave equations and their solutions, use of phasors

Cheng 7.3, 7.4, 7.6, 7.7.1

Lecture 19

Plane waves, polarization, Poynting vector

Cheng 8.1, 8.2 (excl. 8.2.1), 8.5

Lecture 20

Electromagnetic boundary conditions, normal incident at plane conducting and dielectric boundaries

Cheng 7.5, 8.6, 8.8, 11

Lecture 21

Exam information and revision