Electromagnetic Fields - Video course

Electrostatics 16

1 Scalar and Vector fields 2
2 Coulomb's Law and concept of Electric Field 2
3 Divergence, the Divergence Theorem and Gauss' Law 2
4 Concept of Electrostatic Potential, Poisson's Equation 2
5 Energy in the Field, Capacitance 2
6 capacitance of common two-plate capacitors, including two-wire capacitors 2
7 Dielectrics, dielectric boundary conditions 2
8 Solution of Laplace's Equation and Poisson's Equation in 1-D. Capacitance
   calculations with multiple dielectrics 2

Magnetostatics 12

 9 Force due to a Magnetic field, Force due to combined Electric and Magnetic fields 2
10 Biot-Savart Law, calculation of Magnetic Field for simple coil configurations 2

Topic Lectures

11 Ampere's Law 1
12 Magnetic flux, Stokes theorem 2
13 Magnetic materials, magnetic boundary conditions 2
14 Inductance calculations from phi=L*I, for common geometries 2
15 Force on a dipole 1

Slowly Time-Varying Systems 5

16 Frames of reference and motional emf. Faraday's law 2
17 Stored energy in the magnetic field. The Inductance equation 2
18 Examples from electric machines and transformers 1

Time-Varying Fields 13

19 The Displacement current. Maxwell's Equation 2
20 The wave equation in 1-Dimension 1
21 Solution of the wave equation. Plane waves 2
22 Wave propagation in vacuum and lossy dielectrics 2
23 Skin depth and frequency dependence of lumped elements 2
24 Energy transport by waves. The Poynting vector 2
25 Reflection at boundaries. Normal incidence formula. Impedence matching. 2

Total 46

References

1. Principles and Applications of Electromagnetic Fields - Plonsey, R. and
   COllin, R.E., McGraw Hill. 1961.
2. Engineering Electromagnetics - William H. Hayt, Jr. Fifth Edition. TMH.1999.

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