

Macroscopic Electrodynamics II
Physics 5331 Syllabus

7. Time Varying Fields II

Magnetization and bulk motion
Conservation of energy; energy flux
Conservation of momentum; Maxwell stress tensor
Conservation of angular momentum; shear tensor
Viewpoint on effective conservation laws for macroscopic media
Maxwell stress tensor example
Lienard-Wiechart potentials
Green function for half-infinite geometry
Discrete transformation properties of electromagnetic quantities

8. Plane Electromagnetic Waves and Propagation in Matter

Plane waves in dielectric media
Reflection and refraction of plane waves from dielectric interfaces I: \mathbf{E}_\perp polarization
Reflection and refraction of plane waves from dielectric interfaces II: \mathbf{B}_\perp polarization
Brewster's angle and total internal reflection
Simple model for constitutive relations
Model applications to plasmas, metals and dielectrics
Kramers-Kronig relations
Dispersion in one-dimension: theory and example

9. Wave Guides and Resonant Cavities

Boundary conditions near an imperfect conductor
General considerations for wave guides of arbitrary cross section
Example: rectangular waveguide modes
Power loss in waveguides: power method
Power loss in waveguides: perturbation of boundary conditions
Rectangular resonant cavity
Eigenmode expansion for spherical resonant cavity
Energy loss and frequency shift in resonators
Orthogonality properties for wave guide eigenfunctions
Reflection and impedance properties of thin diaphragms in waveguides
Variational examples: thin diaphragms in rectangular waveguides

10. Radiation of Systems and Point Particles; Scattering

EM radiation of systems: harmonic formalism
EM radiation of systems: real source formalism
Frequency distribution of radiated power
Physical interpretation of multipole expansion approximation
Dipole and quadrupole contributions to radiated power
Point particle radiations: Larmor and Lienard results
Synchrotron radiation from periodic trajectories: general considerations
Synchrotron radiation from circular periodic motion
Definition of polarized scattering cross sections
Kirchhoff identity for scattering
Conducting sphere: short wavelength scattering
Optical theorem
Conducting sphere: partial wave techniques

11. Relativistic Formulations of Electrodynamics

The exact relativistic transformation and covariant notation
Relativistic form of Maxwell's equations
The "light cone"
Invariance properties of Lorentz transformations
Energy/momentum aspects of Lorentz transformations
Relativistic kinematics in the context of linear and circular particle accelerators
Relativistic Lagrangian for electrodynamics
Covariant form of the energy-momentum tensor

12. Feynman Wheeler Theory of Radiation Resistance

Background
Feynmann propagator
Radiation reaction calculation
Comments
Adios!
References for Ch.12