Syllabus For One-semester Graduate E & M Course

1. Electromagnetic Theory

The classical limit of electromagnetic fields and sources
Charge-current conservation
Source-independent Maxwell equations; gauge fields; consistency with special relativity;
Faraday's law; induced electric fields
Source-dependent Maxwell equations
Energy-momentum conservation

2. Electrostatics

Electrostatic potential energy and energy density
Dipole moment distributions and continuous matter
Macroscopic equations for dielectric media; local field corrections Electrostatic energy in dielectric media
Introduction to electrostatic/dielectric boundary-value problems

3. Magnetostatics

Magnetic moments
Macroscopic equations for permeable media
Magnetic energy; energetic response to a change in permeability; hard ferromagnets
Introduction to magnetostatic boundary-value problems

4. The Solution Of Electrodynamics Problems

Method of vector/scalar and Hertz potentials; gauge invariance and gauge fixing
Green functions for radiation
Multipole radiation from localized charge-current distributions
Wave propagation in linear dielectric, conducting, and dispersive media, with open and confined geometries

5. Radiation From Accelerated Charges

Lienard-Wiechert potentials
Cherenkov, synchrotron, and transition radiation