Syllabus
Professor Howard Schnitzer
Physics 161a Electromagnetic Theory I

1) Cartesian tensors
2) Green’s theorems
   Special Cases: Gauss’ Theorem
3) Decomposition of vector fields in 3-dimensions into longitudinal and transverse parts. Needs \{δ-functions/Green’s functions\}
4) Green’s functions (In homogeneous)
   Find by:
      a) Fourier transform
      b) Gauss’ theorem
5) Boundary conditions on fields at discontinuities
6) Dirichlet & Neumann boundary value problem
7) Multiple expansion using Cartesian multipoles (i.e. symmetric traceless tensors), various applications; e.g. Energy, force, torque on systems of charges.
   Identify multipoles using qualitative arguments [symmetry & parity].
8) Dielectrics
9) Separation of variables
   a) 2-Dim [rectangular, circular]
   b) 3-D Legendre’s equation and spherical harmonics
   c) Sturm-Lionville systems & generalized Fourier series
10) Solution of 2D problems by complex variables and conformal maps. Discuss conformal symmetry.
11) Solution of special 3D problems using conformal symmetry [i.e. inversion]
12) Bessel functions
13) Steady-state currents, and magnetism.