

Typical PhD Screening Exam Topics: Electromagnetics

Electrostatics: Coulomb's Law, Gauss' Law, electric potential, line, surface and volume charge distributions, electric flux density, dielectric constant; boundary conditions, Poisson and Laplace equations, boundary value problems, capacitance, and energy.

Magnetostatics: current density, Ohm's Law, Kirchoff's Laws, resistance calculations; magnetic flux density, magnetic field, magnetic vector potential; permeability, Biot-Savart Law, boundary conditions, inductance and magnetic energy.

Time varying fields: Maxwell's Equations, boundary conditions, time-harmonic waves, homogeneous plane waves, polarization, Poynting vector; reflection from plane boundaries, Fresnel reflection coefficients; waves in lossy media, phase and group velocities.

Transmission lines: Transmission line parameters and equations, loaded transmission lines, reflection coefficient and VSWR, basic Smith chart calculations; transients on a transmission line.

Waveguides and resonators: TEM, TE, TM waves, guided modes in parallel plate and rectangular waveguides, cutoff frequencies, attenuation, phase and group velocities; modes in cavity resonators, resonant frequencies and quality factors.

Fundamental antenna parameters: Near and far zones, radiation pattern, directivity, radiation resistance and input impedance, radiation efficiency and gain, aperture area, aperture efficiency, radiation integrals.

Antennas: Wire antennas (dipoles and loops), horn antennas, reflector antennas; linear antenna arrays, mutual coupling and Yagi antennas.

Propagation: Free space transmission, reflections from an infinite flat ground (multipath).

D. C. Jenn 3/02

Note: This list is provided only as a guideline to the student and may not be completely comprehensive. Examiners reserve the right to determine specific areas of concentration, and students may be examined on any topic that broadly relates to the area.