Chapter 4: Students should be able to:

- ☐ Convert between viewing dipoles as point charges to generalized dipole vectors and back
- ☐ Calculate the dipole moment of simple charge distributions
- ☐ Describe similarities and differences between conductors and dielectrics
- ☐ Predict whether a particular polarization would yield bound surface and/or volume charge densities
- ☐ Explain the physical origin of bound charge at micro and macroscopic levels
- ☐ Explain what happens to a dielectric placed in an electric field
- ☐ Explain the difference between free and bound charges and identify which is which in a problem
- ☐ Sketch the direction of $\vec{\mathbf{D}}$, $\vec{\mathbf{P}}$, and $\vec{\mathbf{E}}$ for simple problems involving dielectrics
- ☐ Determine appropriate boundary conditions fo $\vec{\mathbf{D}}$ given free charge or a linear dielectric
- ☐ Articulate the difference between linear and nonlinear dielectrics
- ☐ Calculate $\vec{\mathbf{E}}$, and $\vec{\mathbf{P}}$ given a dielectric constant and free charge distribution of nice symmetry

Chapter 5: Students should be able to:

- ☐ Utilize the Lorentz force law and right-hand rule
- ☐ Calculate current density given the current $\mathcal{I}$ and know the respective units
- ☐ Explain in words what the charge continuity equation means
- ☐ Calculate the current $\mathcal{I}$, K, and J in terms of particle velocity or in terms of each other
- ☐ Describe the trajectory of a charged particle in a given magnetic field
- ☐ Sketch the direction of the magnetic field about a current distribution and explain why any components or dependencies are zero
- ☐ Explain why the magnetic force does no work
- ☐ State when the Biot-Savart Law applies
- ☐ Compare similarities and differences between Biot-Savart and Coulomb's Law
- ☐ Choose when to use Biot-Savart versus Ampere's Law to calculate B fields
- ☐ Use Biot-Savart to calculate B fields in simple cases
- ☐ Draw appropriate Amperian loops for cases where symmetry allows and solve for the B field in that fashion
- ☐ Make comparisions between $\vec{\mathbf{E}}$ and $\vec{\mathbf{B}}$ in Maxwell's equations
- ☐ Explain why the potential $\vec{\mathbf{A}}$ is a vector for magnetostatics but a scalar for electrostatics
- ☐ Recognize when it is useful to use the vector potential in solving problems
- ☐ Interpret the third and fourth Maxwell's equations for electrostatics (divergence and curl of B) and use them to describe magnetostatics

Computation: Students should be able to:

- ☐ Create simple line plots showing relationships between 2 or 3 variables
- ☐ Visualize functions of 2 independent variables using `imshow` or contour plots
- ☐ Label plot axes correctly and with descriptive titles
- ☐ Use Sympy for basic integration or differentiation tasks