

Review III – Electrodynamics (Chap 7)

1. Ohm's law, EMF, flux rule (Chap 7.1)
 - a. Must know the local Ohm's law and Ohm's law. Know how to calculate the resistance. Must know how to calculate Joule heating.
 - b. Must understand the definition of EMF. Must understand the difference between the motional EMF and induced EMF. Must know what force drives current, and what agent does the work.
 - c. Must be able to determine the EMF and current (both magnitude and direction) in a circuit using the flux rule, Len'z law, and Ohm's law.

2. Induction (Chap 7.2.1-7.2.2)
 - a. Must know Faraday's law.
 - b. Must be able to calculate the induced EMF and induced current in a circuit using the flux rule (see 1.c).
 - c. Must be able to calculate the induced electric field using the integral form of Faraday's law in configurations of symmetry (see class examples and your HW problems); for example:
 - a solenoid carrying a time varying current.
 - a long wire carrying a time-varying current; a long cylinder conductor carrying an axial volume current; a long cylindrical shell conductor carrying an axial surface current
 - a large slab carrying a volume current or surface current

3. Inductance (Chap 7.2.3-7.2.4)
 - a. Must understand the definitions of self-inductance L and mutual inductance M .
 - b. must be able to calculate L and M in given configurations (see class examples and HW problems) ; eg:
 - self-inductance of a long solenoid
 - self-inductance of a toroidal coil
 - self-inductance of a long coaxial cylindrical shell conductor
 - self-inductance of parallel long wires
 - mutual inductance of two co-axial solenoids
 - mutual inductance of a long wire and a small square loop
 - c. must be able to calculate the induced EMFs and currents in circuits through self-induction and/or mutual induction; eg., an AC transformer (see class notes and HW problems).
 - d. Must be able to calculate the magnetic energy $W_B = \int \frac{1}{2\mu_0} B^2 d\tau = \frac{1}{2} LI^2$ in various configurations; eg, solenoid, cylindrical conductor, slab conductor, toroidal coil. Must be able to find the self-inductance from the magnetic energy.