1 Key

- F2014p1 is Final exam 2014 problem 1
- C1 is comps problems 1
- HW10p1 is homework 10 problem 1

2 Radiation and Scattering in Non-relativistic systems.

1. Use Larmour, electric dipole, magnetic dipole, electric quadrupole radiation to compute radiation patterns and scattering.
   (a) Larmor F2014p2, C3, HW9p2
   (b) Electric Dipole C3, C4, C2, F2015p1, HW9p2
   (c) Magnetic Dipole F2014p1 and scattering HW13p6
   (d) Thompson scattering HW13p5, dipole scattering C2, scattering from a metal sphere HW13p6.
2. Interference between multiple sources of radiation F2015p1, HW9p3, C2
3. Formal. Derive the electric dipole radiation and Larmour formula from maxwell equations, qualitatively understand where the higher multipoles come from (see C3,F2104p2, also C1 (a) and (b) and lecture).
4. Understand near field and far field HW9p1, C2
5. Antennas (HW9p3, F2014p1) and Born approximation Scattering from sphere done in class

3 Formal aspects of Maxwell Equations and Relativity

1. Gauge invariance, current conservation, covariance waves, covariant stress tensor, Bianchi identity
   (a) See HW9p5, HW9p6, HW10p1, HW10p4
2. Write down the action of Maxwell equations and varying the action to determine the equations of motion. See lecture
3. Write down the action of a relativistic point particle and varying the action to determine the equations of motion. See lecture
   (a) HW10p4, F2014p2, HW10p2
4. Transformation of fields and currents. Electrodynamics and relativity
   (a) Fields of a point particle F2013p3, currents in cylinder HW10p5. moving sphere F2015p2, stress in sheets HW11p6, stress in plates C5.

4 Radiation from relativistic particles

1. Formal. Derive the Lienard-Wiechert potential and check Lorentz gauge condition C1,C3. Derive formulas such as Eq. 13.16 and 13.17 of class notes (see lectures) (though this last item will probably not be on the test directly it is important to understand everything else).

2. Compute the energy radiated during various motion HW11p4,HW11p5,F2013p3,F2014p3,Linear acceleration (lectures)

3. Compute the frequency spectrum for some problems F2014p3 (great problem for homework, but was too hard for a final), HW13p2, HW13p3 F2015p3

4. Compute the bremsstrahlung spectrum during a collision and analyze the result HW13p4, lecture

5. Elements of synchrotron radiation lecture. Carefully explain the frequency width.