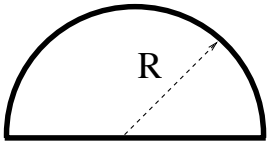
804 Final Exam (40 points). 05/02/12, 12:00 - 15:00

Problem 1
A circularly polarized electromagnetic plane wave is normally incident on an infinitely large plane made from a perfect conductor. Find the charge and current densities induced on the conducting plane.

Problem 2.
Find the cutoff frequency for the **TM** modes propagating in the cylindrical wave guide with the half-moon cross section (the roots of Bessel functions may be found in *Jackson*).



Hint: Look at the solutions for cylindrical wave guide and think about the symmetries of the system.

Problem 3.
A particle of charge q moves in a circle of radius a at a constant angular velocity ω. Assume that the circle lies in the x, y plane, centered at the origin and at time $t = 0$, the charge is at $(a, 0)$ on the positive x axis. For points on the z axis, find
(a) the Lienard-Wiechert potentials and
(b) the time-averaged electric field.

Problem 4.
A particle of charge q and mass m moves through an empty space with the velocity $\vec{v} = v\hat{e}_1$ ($v \ll c$). At time $t = 0$, the uniform magnetic field $\vec{B} = B\hat{e}_3$ is switched on. How long it will take the particle to lose half of its kinetic energy? (Assume that the magnetic field is sufficiently weak so that the particle loses half of its energy after many revolutions).

Problem 5.
In a certain frame K the electric field $\vec{E}$ and the magnetic filed $\vec{B}$ are orthogonal. Is there a frame where the field is
(a) purely electric or (b) purely magnetic,
and with what velocity should that frame(s) move with respect to K?

Problem 6.
A π^+ meson with mass 139.6 MeV decays into μ^+-meson with mass 105.7 MeV and massless ν_μ neutrino. What is the velocity (in units of c) of μ^+-meson in the c.m. frame of μ^+ and ν_μ?

All problems have equal weight. *GOOD LUCK*!