Physics 301-24
Assignment 5

1)[6] Using the static approximation for the fields:

a) Show that in free space between two infinite plane conductors the E field is perpendicular to the conductors and is constant. What is the force per unit area and direction that the EM field exerts on itself. or on the plates.

b) Above a superconductor, the B field is parallel to the conductor. Assume one has two parallel slabs of superconductor, what is the pressure of the field on itself

2)[4] Consider a straight circular wire carrying a current I alon the conductor. Thewire has a conductivity σ which is the proportionality of the E field to the current.

$$\vec{J} = \sigma \vec{E} \tag{1}$$

Assuming that the magnetic field around the wire is $B = \mu_0 \frac{I}{r}$ in the tangential direction obeying the right hand rule:(Thumb of right hand points in direction of $\vec{J}$, then half open fist fingers point in direction of $\vec{B}$). What is the energy flux into the wire from the electromagnetic field just outside the wire?

3)[5] Consider an infinite solenoid (a cylindrical hollow conductor) with a circumfrential uniform current flowing around the hollow. Assume by symmetry that the B field is directed in the direction of the axis of the cylinder. Argue that the B field is constant inside the cylinder and is zero outside the cylinder. Use Stokes theorem.

4.)[6] Calculate the force between two electric ~~and two magnetic~~ dipoles if both are oriented so that the two dipole directions are parallel to each other and each is located along the axis of the other (the axis is the line running through one of the dipoles in the direction of the electric ~~or magnetic~~ dipole). You may assume that they are far apart from each other–ie, separated by much more than the diameter of the charge ~~or current~~ distributions. .

Note that you can model the dipole as two point charges, of opposite charge, separated by a small distance δ Keep only the lowest order terms in delta.
