PHY102: Assignment 7

1. Find the magnetic field at the centre of a square current loop of side L.

2. Find the magnetic field at the centre of a circular current loop of radius R.

3. An infinite cylinder of radius R is carrying current with density $\vec{J}(r) = \alpha e^{-\beta r} \hat{z}$. $\hat{z}$ is a unit vector parallel to the axis of the cylinder. Find out the magnetic field inside and outside the cylinder.

4. Find the magnetic field inside and outside of an infinite solenoid of n closely wound turns per unit length on a cylinder of radius R.

5. A coaxial cable consists of two very long cylindrical tubes, separated by linear insulating material of magnetic susceptibility χ_m. A current I flows down the inner conductor and returns along the outer one; in each case the current distributes itself uniformly over the surface. Find the magnetic field in the region between the tubes. As a check, calculate the magnetization and the bound currents, and confirm that they generate the current field.

6. A current I flow down a long straight wire of radius a. If the wire is made of linear material with susceptibility χ_m, and the current is distributed uniformly, what is the magnetic field a distance s from the axis? Find all the bound currents. What is the net bound current flowing down the wire?