Problem 1 : The figure below shows the circular cross section of radius $R = 0.003\,\mathrm{m}$ of an infinitely long wire with uniform current density carrying a time dependent current $I(t) = 2\,t\,\mathrm{A/s}$ which is in the $\hat{z}$ direction. Embedded within the wire in the x-z plane is a square loop of insulated wire which extends a distance $L = 0.01\,\mathrm{m}$ in the z direction and from $x_1 = 0.001\,\mathrm{m}$ to $x_2 = 0.002\,\mathrm{m}$ in the x direction. If the resistance in the loop is $R_{res} = 1\,\Omega$, find the current $I_\ell(t)$ in the loop, and indicate its direction in a diagram where the y axis points out of the page.

Problem 2 : The figure below shows the circular cross section of radius $R = 0.03\,\mathrm{m}$ between two poles of an electromagnet. The magnetic field is uniform between the poles and vanishes outside them. It points in the z direction and increases as $B = 0.1\,t\,\mathrm{T/s}$. Find the electric field $\vec{E}(r,t)$, indicating its direction, for radii $r < R$ and $r > R$.