

Electromagnetism I – Problem sheet 4

1. Derive an expression for the electric field, \underline{E}_{in} at any point within the space between a cylindrical conducting rod and a coaxial conducting tube around it. The rod and tube carry charges per unit length $+\lambda$ and $-\lambda$, respectively. The finite radius of the rod is r_1 and that of the tube is r_2 , with $r_2 > r_1$. [2]
2. Compute the value of the electric field, \underline{E}_{out} outside the tube. [1]
3. If the charge density on the coaxial tube is changed to -2λ , what effect will it have on the electric field for:
 - (a) $r_1 < r < r_2$? [1]
 - (b) $r > r_2$? [1]
4. From the result obtained in part (1), find an expression for the potential difference between the rod and the tube. [2]
5. If the potential at infinity is defined as zero, what is the potential of the rod? [1]
6. Sketch the electric field and electric potential as functions of r , including regions inside the rod and outside the tube. [2]