FUNDAMENTALS OF ELECTROMAGNETIC FIELDS – Jan 31, 2017

Name:
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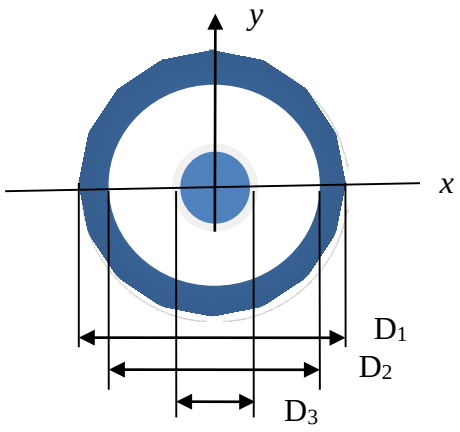
Problem 1 - Consider a uniformly charged sphere of radius R=3 cm and placed at the origin of the coordinate system**.** The total charge on the sphere is 0.1 C. Find

- The maximum value of the electrostatic potential in the whole space and its position;
- The maximum value of the electric field in the whole space and its position
- The distance/distances from the origin where the potential is half its maximum value.

Problem 2 - Consider the indefinite coaxial cylinder whose section is shown in the figure (diameter D_1 = 18 mm, D_2 = 17 mm, D_3 = 9 mm). The dark regions represent metallic conductors. On the outer conductor there flows a current of 1 A (directed **inside** the paper) uniformly distributed on the whole conductor and on the inner conductor there flows a current of 2 A (directed **outside** the paper. Find the magnetic field at the middle of the outer conductor and compute the power dissipated on a 1 m cable.

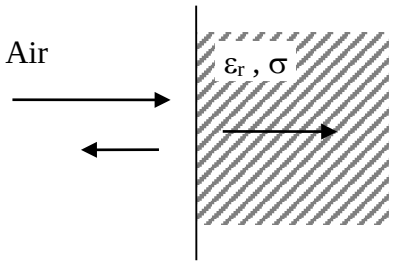


Problem 3 - A plane wave at 12 GHz and having a power density of 5 mW/m^2 is normally incident on a medium with $\varepsilon_r = 3$, $\sigma = 0.3$ S/m. Find

a) the total electric field at the interface (magnitude);

b) the total magnetic field at 1 cm from the interface in medium 1;

d) the total magnetic field at 1 cm from the interface in medium 2;



Problem 4 - A source with 10 W available power and 75 Ω internal impedance is connected to a 150 Ω load by a 150 Ω characteristic impedance transmission line. The line length is 15 m, the frequency is 2 GHz and the line is a parallel plate line with the following parameters:
width w = 0.5, heght h (to be found), $\varepsilon_r = 1$, conductivity of metals $\sigma = 5 \cdot 10^7$ S/m.
Find

a) The power absorbed by the load;
b) The power lost on the line.