FUNDAMENTALS OF ELECTROMAGNETIC FIELDS – Feb. 3, 2015

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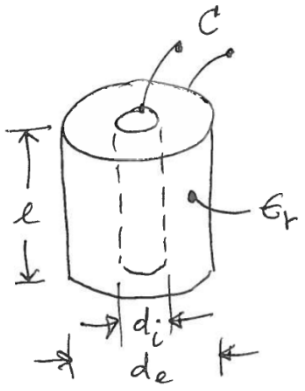
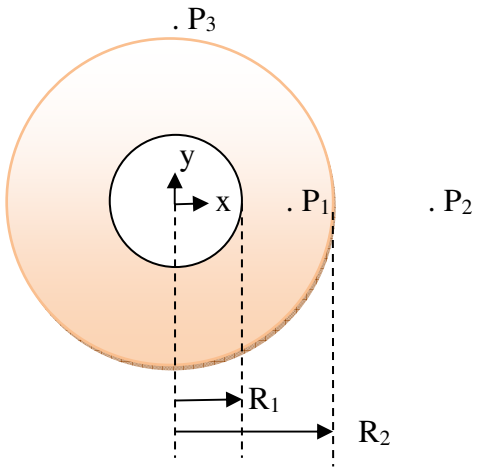
Problem 1 **-** In order to measure the relative dielectric constant of a liquid, a coaxial capacitor is used (see Fig.). The capacitor is filled with the liquid and the impedance at terminals 'C' in the Fig. is measured at 10 MHz. The value measured is Z = –j830 Ω. Find the relative dielectric constant of the liquid knowing that d_i = 1 cm, d_e = 1.5 cm, l = 4 cm.



Problem 2 - A total current of 2 A flows in an infinitely long hollow conductor (see Fig.). By assuming a uniform current distribution, find the magnetic field (magnitude and direction) at points P_1, P_2 and P_3.

R_1=2 cm, R_2 = 4 cm,

P_1 = (3cm, 0), P_2 = (30cm, 0), P_3 = (0, 4.5cm).



Problem 3 - A plane wave having an amplitude of the electric field of 2 mV/m is normally incident on a conductor. Find

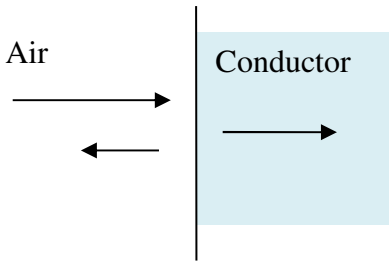
a) the electric field amplitude of the scattered wave;

b) the electric field amplitude of the transmitted wave;

c) the magnetic field amplitude at the interface;

d) the relative power absorbed by the conductor.

The frequency is 100 MHz and the conductivity of the conductor is 0.1 S/m.



Problem 4 - A source with 10 W available power and 100 Ω internal impedance is connected to a 150 Ω load by a 50 Ω characteristic impedance transmission line. The line length is 3 m and the frequency is 270 MHz. Find

a) The power absorbed by the load;
b) The current at the source.