SB/HCV

PHY 103: General Physics 2 (2014 – 2015, Semester – I)

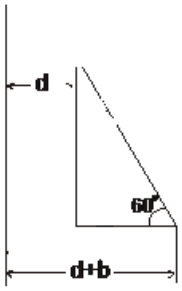
Department of Physics

Indian Institute of Technology - Kanpur

Assignment- 10

(*ed questions will not be done in tutorial)

1* Determine the mutual inductance between a conducting triangular loop and a very long straight wire as shown in figure.

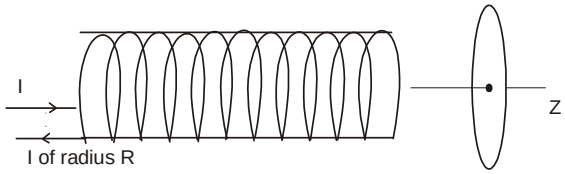


2 Determine the inductance per unit length of an air coaxial transmission line that has a solid inner conductor of radius a and a very thin outer conductor of inner radius b.

3* Two wire loops, placed close by, carry currents I_1, and I_2. Their self inductances are L_1, L_2 respectively and mutual inductance M. Show that the magnetic energy corresponding to this combination $V = \frac{1}{2}\left[L_1 I_1^2 + 2MI_1 I_2 + L_2 I_2^2\right]$

4 An atomic electron (charge q) circles about the nucleus (charge Q) in an orbit of radius r. The centripetal acceleration is provided by the Coulomb attraction of opposite charges. Now a small magnetic field dB is slowly turned on, perpendicular to the plane of the orbit. Show that the increase in kinetic energy, dT, imparted by the induced electric field, is just right to sustain the circular motion at the same radius r.

5* A cylindrical coil with its axis along the z-axis carries a current I. There is a circular wire loop of radius R placed at a certain distance with its axis also along the z-axis. The mutual inductance between the two circuits is M. Find the ϕ component of the magnetic vector potential due to the current I in the coil at the circular wire loop.



6 The self inductance of coil b is twice that of coil a. when they are connected as in Figure (i), the net inductance of the combination is 80 mH. When they are connected as as in Figure (ii) the net inductance is 40 mH. Find the mutual inductance between a and b.