KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT

EE340-Lab [151] sec #52	Lab Quiz: #3	30 Nov 2015
Name: Solution	ID:__________	Grade:______

Problem 1).

a) Two long parallel wires, carrying magnitudes of currents $I_1 = 5\ A$ and $I_2 = 3I_1 = 15A$ respectively are 8 cm apart as shown in the picture below. Sketch the magnetic field intensity of the two wires.

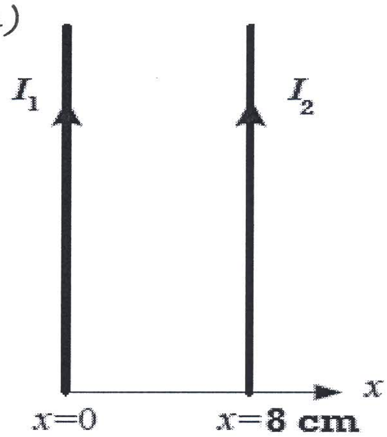
$$|B| = \frac{\mu_0 I_1}{2\pi x} + \frac{\mu_0 I_2}{2\pi (x-a)}$$

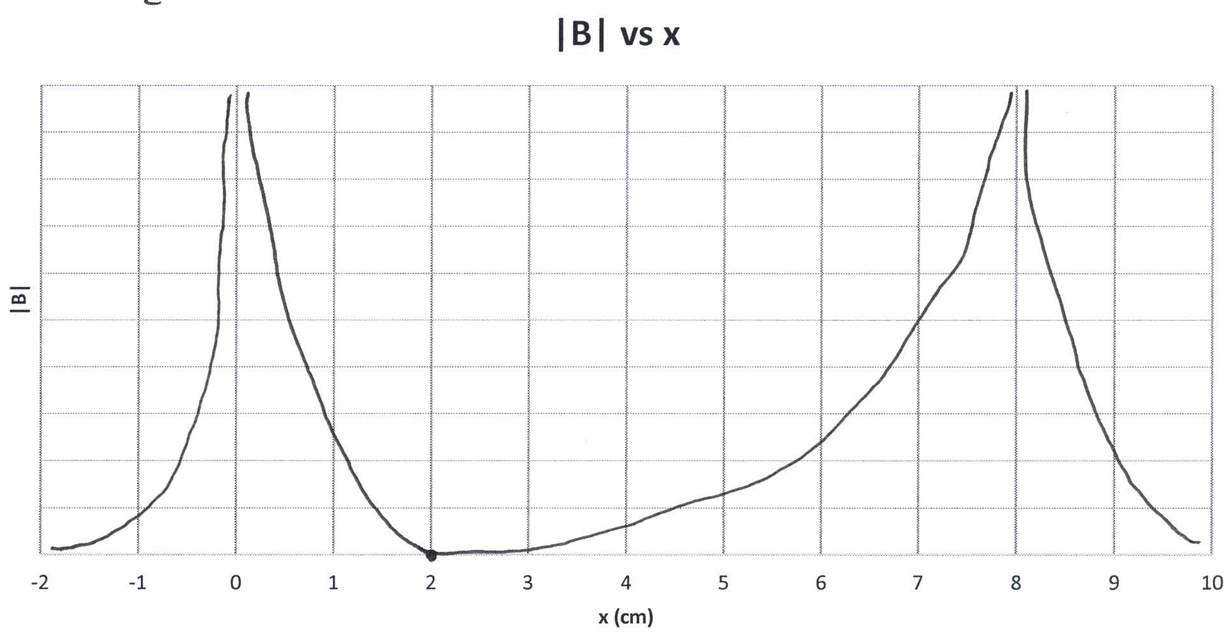
$$|B| = 0$$

$$\Rightarrow \frac{I_1}{x} = \frac{I_2}{a-x}$$

$$a I_1 - x I_1 = I_2 x$$

$$x = \frac{a I_1}{I_1 + I_2} = \frac{8 \times 5}{5+15} = 2\ \text{cm}$$





Problem 2).

a) A plane circular loop of conducting wire of radius $r = 10cm$ which possesses $N = 15$ turns is placed in a uniform magnetic field. The magnetic field-strength B is increased at a constant rate from $B_1 = 1\,T$ to $B_2 = 5\,T$ in a time interval of $\Delta t = 10\,s$.
What is the induced voltage generated around the loop?

$$V = -N \frac{d\psi}{dt} \; ; \quad \psi = \int_s B.ds = BA = B\pi r^2 \qquad \frac{5-1}{10} \rightarrow$$

$$V = -N(\pi r^2)\frac{dB}{dt} = -N\pi r^2 \frac{\Delta B}{\Delta t} = -15 \times \pi \times (10 \times 10^{-2})^2 \frac{4}{10}$$

$$= 0.1884\ V$$

b) A large solenoidal field coil with $n = 485\ turns/meter$ and $L = 750\ mm$ long, is used to generate a magnetic field by passing a DC current ($I_1 = 5\,A$) through it. An Induction coil, $N_0 = 300\ turns$ and $2a = 41\ mm$ diameter, is placed in the field coil.
Calculate the induced the voltage in the induction coil.

DC current $\longrightarrow \omega = 0$

$\Rightarrow V = 0\ V$

Problem 3)

a) What is the advantage of using high frequency in antenna communication?

Small Antennal

b) Why we used the horn-shaped antenna?

Impedance matching

c) Specify for the given fields:

i. The type of polarization (Linear, Circular or Elliptical)

ii. Sense of the rotation [Clockwise (CW) or Counterclockwise (CCW)] (for circular and elliptical) and the tilt angle θ for linear polarization.

iii. Draw the field as seen from the polarization point of view.

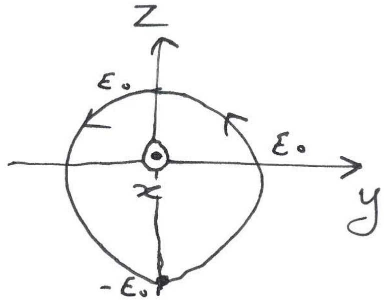
1. $\overline{E} = -\bar{a}_z(E_0)\cos(\omega t + \beta x) + \bar{a}_y(E_0)\sin(\omega t + \beta x)$ $\rightarrow -x$

$x = 0$

$\overline{E}$	ωt
$-E_0 \vec{a}_z$	0
$+E_0 \vec{a}_y$	$\pi/2$
$E_0 \vec{a}_z$	π
$-E_0 \vec{a}_y$	$3\pi/2$

i. Circular

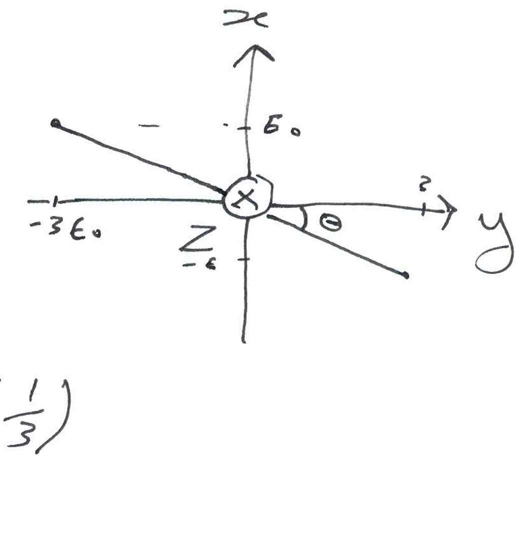
ii. CCW



2. $\overline{E} = \bar{a}_x(E_0)\cos(\omega t - \beta z) - \bar{a}_y(3E_0)\cos(\omega t - \beta z)$

$+z$

ωt	$\overline{E}$
0	$E_0 \vec{a}_x - 3E_0 \vec{a}_y$
$\pi/2$	0
π	$-E_0 \vec{a}_x + 3E_0 \vec{a}_y$



i. Linear

ii. $\theta = \tan^{-1}\left(\frac{1}{3}\right)$