Assignment

ELECTROTECHNOLOGY
ELTK1100
ASSIGNMENT #9
SOLUTIONS

1.

$$V_{IND} = NB\ell v = 1 * 0.5\mu T * 0.5m * 25m/s = 6.25\mu V$$

2.

$\phi_1 = 10\mu Wb$

$\phi_2 = 0$

$\Delta\phi = \phi_1 - \phi_2$

$$V_{IND} = N\frac{\Delta\phi}{\Delta t} = 1000t * \frac{(10\mu Wb - 0)}{10ms} = 1V$$

3.

$$V_{IND} = NB\ell v = 1 * 2mT * 30cm * \frac{55\ km}{hr} * \frac{1000m}{1km} * \frac{1hr}{3600s} = 9.17mV$$

4. **(a)**

$\phi_1 = 100\mu Wb$

$\phi_2 = 0$

$\Delta\phi = \phi_1 - \phi_2$

$$V_{IND} = N\frac{\Delta\phi}{\Delta t} = 2500t * \frac{(100\mu Wb - 0)}{0.06s} = 4.17V$$

(b)

$\phi_1 = 100\mu Wb$

$\phi_2 = -100\mu Wb$

$\Delta\phi = \phi_1 - \phi_2$

$$V_{IND} = N\frac{\Delta\phi}{\Delta t} = 2500t * \frac{(100\mu Wb - (-100\mu Wb))}{500ms} = 1V$$

5.

$\Delta\phi = \phi_1 - \phi_2$

$$\phi = \frac{F_m}{R_m} = \frac{N\ I}{R_m} = \frac{1500t * 150mA}{1 * 10^5 \frac{A \cdot t}{Wb}} = 2.25mWb$$

$\phi_1 = 2.25mWb$

$\phi_2 = 0$

$$V_{IND} = N\frac{\Delta\phi}{\Delta t} = 1500t * \frac{(2.25mWb - 0)}{0.02s} = 169V$$

6.

$I_1 = 9A$ $\qquad \Delta I = I_1 - I_2$

$I_2 = 0$

$$V_{IND} = L \frac{\Delta I}{\Delta t}$$

$$\therefore \quad L = V_{IND} * \frac{\Delta t}{\Delta I} = 11V * \frac{6s}{(9A - 0A)} = 7.33H$$

$$L = \frac{N^2}{R_m}$$

$$\therefore \quad R_m = \frac{N^2}{L} = \frac{(205t)^2}{7.33H} = 5733 \frac{A \cdot t}{Wb}$$

7. (a)

$$L_T = L_1 + L_2 = 20H + 30H = 50H$$

(b)

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} = \frac{1}{20H} + \frac{1}{30H} = 0.08333$$

$$L_T = \frac{1}{0.08333} = 12H$$

8. (a) From **7(a)** L = 50H

$I_1 = 1A$ $\qquad \Delta I = I_1 - I_2$

$I_2 = 2A$

$$V_{IND} = L \frac{\Delta I}{\Delta t} = 50H * \frac{(1A - 2A)}{0.02s} = -2500V$$

(b) From **7(b)** L = 12H

$I_1 = 1A$ $\qquad \Delta I = I_1 - I_2$

$I_2 = 2A$

$$V_{IND} = L \frac{\Delta I}{\Delta t} = 12H * \frac{(1A - 2A)}{0.02s} = -600V$$

The voltage induced can be positive or negative (Lenz's Law) because the inductor opposes the change in current which induced the voltage.