UyuPHYS 204 **Quiz 1** Instructor: **Dr. T. Al-Abdullah**

Name:_____, ID:_____

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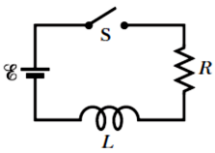
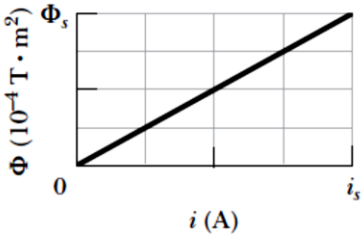
Q1) In the left figure, the inductor has 25 turns and the ideal battery has an emf of 16 V. The right figure gives the magnetic flux ϕ through each turn versus the current i through the inductor. The vertical axis scale is set by $\phi_s = 4 \times 10^{-4}$ T.m^2, and the horizontal axis scale is set by is $i_s = 2.00$ A. If switch S is closed at time $t = 0$, at what rate di/dt will the current be changing at $t = 1.5\tau_L$?

$N\Phi = Li$

$L = N\frac{\Delta\Phi}{\Delta i} \Rightarrow L = 25 * \frac{4\times10^{-4}}{2}$

$= 5\,mH$





$i = \frac{\mathcal{E}}{R}(1 - e^{-t/\tau_L}) \Rightarrow \frac{di}{dt} = \frac{\mathcal{E}}{L} e^{-t/\tau}$

$\Rightarrow \frac{di}{dt} = \frac{\mathcal{E}}{L} e^{-1.5} = \frac{16}{5\times10^{-3}} e^{-1.5} = 7.14\,\frac{A}{s}$

Q2) Two coils are at fixed locations. When coil 1 has no current and the current in coil 2 increases at the rate 15.0 A/s, the emf in coil 1 is 25.0 mV. (a) What is their mutual inductance? (b) When coil 2 has no current and coil 1 has a current of 3.60 A, what is the flux linkage in coil 2?

(a) 1 2

$\mathcal{E}_{ind} = 25\,mV \quad \frac{di_2}{dt} = 15\,A/s$

$\Rightarrow \mathcal{E}_1 = -M\frac{di_2}{dt} \Rightarrow M = \frac{\mathcal{E}_1}{di/dt} = 1.67\,mV$

(b) 1 2

$i_1 = 3.6A \quad \mathcal{E}_{21}$

$N_2\Phi_{21} = Mi_1 = 6.00\,mWb$