ENGR 12 TEST 3 100 Points NAME: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| 1. (10 pts) A **0.1H** inductor is driven by the a current pulse *i(t) = 4t-t2* Amps over the time interval *0<=t<=4* seconds. The current is 0 outside of this time period. |  |

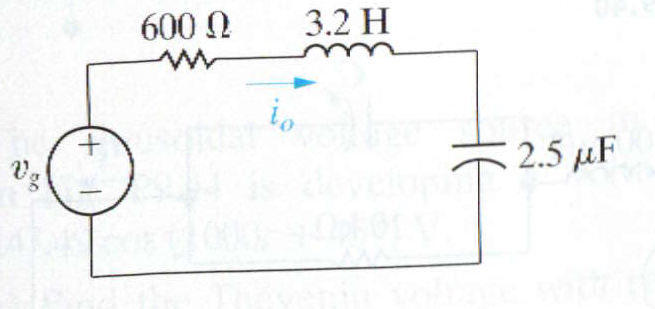
* 1. Find the voltage over this same time period:

.1( 4 – 2t) V

* 1. What is the energy in the inductor at 0 sec:\_\_\_\_0\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2 sec\_\_\_\_\_\_\_\_\_\_\_\_\_\_0.8J\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. (20 pts) Find the steady state solution for io(t) if vg(t) = 40cos(500t) Volts



W = 500

ZL = j 3.2\*500= 1600j

ZC = -j/(500\*2.5x10^-6) = -800 j

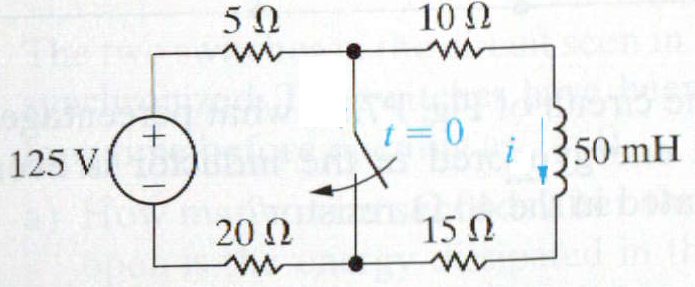
Ztotal = 600 + j(1600-800) = 600 + 800 j

Vg = 40<0

Io = Vg/Ztotal = 40 / (600 +800j) = .024 - .032i = .04 < -53.13

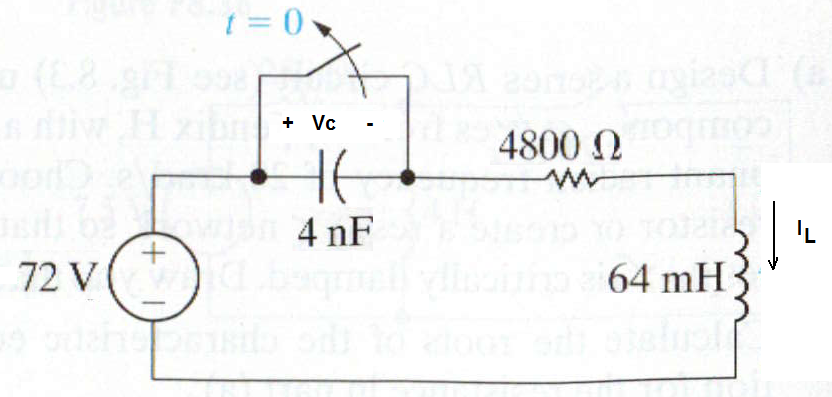
Io(t) = 40 cos (500t -53.13 ) mA

1. (30 pts) The switch has been open in the following circuit for a long time before closing at t=0.



Find

1. this is a (circle one) **natural**/step response
2. the initial current i in the inductor at t=0- \_\_125/50 = 2.5A\_\_\_
3. the final current i in the inductor at t = infinity \_\_0A\_\_\_
4. the effective resistance seen by the inductor for t>0 \_\_25 Ohm\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
5. time constant tau for t>0 \_\_\_\_\_\_L/R .05/25 = .002s
6. the expression for i(t) for t>0 \_\_\_\_\_\_2.5 e –t/.002\_=\_\_2.5 e –500t
7. (40 pts) The switch has been closed a long time before opening at t=0



1. this is a (circle one of each pair) **series**/parallel **step**/natural response
2. Find IL(0-) \_\_\_\_\_\_72/4800 = 15mA\_\_\_\_\_\_\_
3. Find Vc(0-) \_\_\_\_\_0\_\_\_\_
4. Find IL(∞) \_\_\_\_\_0\_\_\_\_\_
5. Find Vc(∞) \_\_\_\_\_72\_\_\_\_\_\_
6. Find α \_\_\_R/2L = 37500\_\_\_\_\_\_
7. Find wo \_\_1/sqrt(LC) = 62500\_\_\_\_\_\_\_\_
8. Critically Damped, Underdamped or Overdamped ? \_\_\_\_\_\_\_\_\_UNDER\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Find dVc/dt(0+) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

dVc(0+)/dt = ic(0+)/C = IL(0+)/C = IL(0-)/C = .015A / 4x10^-9 = 3,750,000 V/s  
Vc(0+) = 0

1. Find the complete solution for v(t) for t>0

Wd = sqrt(wo^2 – a^2) = 50000

V(0+) = 72 + B1

dVc/dt(0+) = - a B1 + wd B2

B1 = -72

3.75x10^6 = -37500B1 + 50000B2 , B2 = 21

V(t) = + 72 + e-37500t (- 72cos(50000t) + 21 sin(50000t))