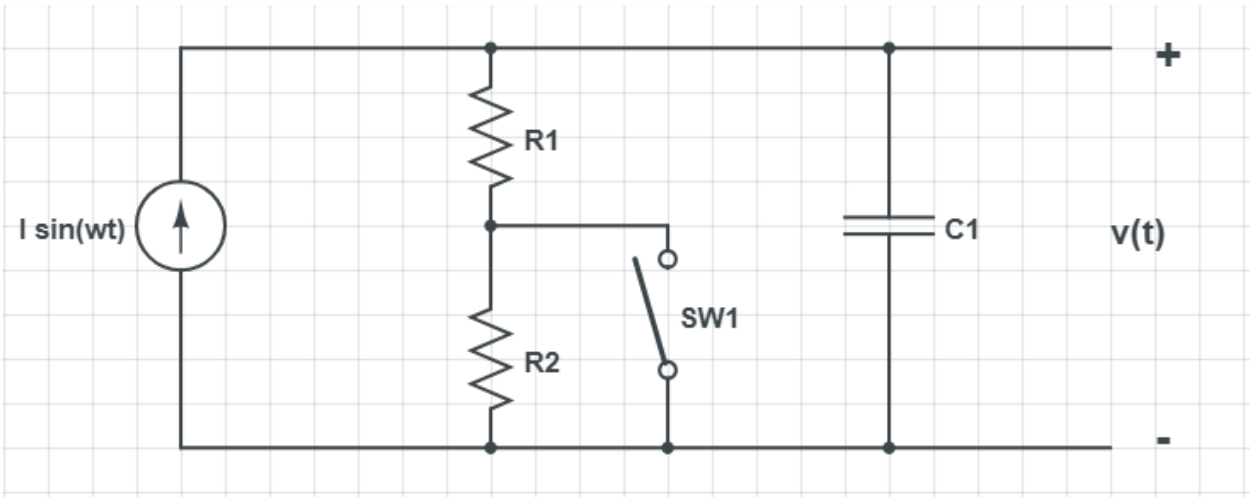
Fall 2018: EE-240 Circuits I
Assignment # 05
Due Date: 06 December 2018, Thursday

Please read the following instructions:

- Submit the assignment on A-4 sheets bound together. Please note that assignments submitted from torn notebook pages will not be accepted.
- You are required to submit the assignment at the start of class on the due date. Late submissions will not be accepted.
- Please ensure that you have clearly written your name and roll numbers on the assignment.
- The assignment is long, so you are advised to start as soon as possible. Please note that no deadline extension requests will be entertained.
- You are aware of the LUMS honor code and therefore, any plagiarism attempts will be directly reported to the Disciplinary Committee. If you are facing any difficulties or have questions, ask the course staff (Instructor/TA), they are there to help you.

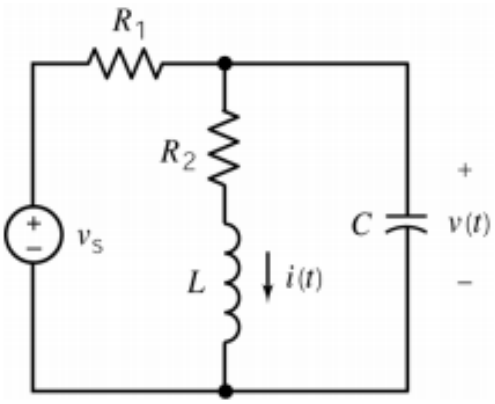
The total marks for the assignment are **100.**

Q1: The switch SW1 is opened for a long time until the network is in steady state. At t=0, the switch is closed. Find v(t) for t>0. [15]



Q2: Find a second-order differential equation in terms or R_1,R_2, L and C that represents this circuit. Suggest values of each component for which the system is: [10]

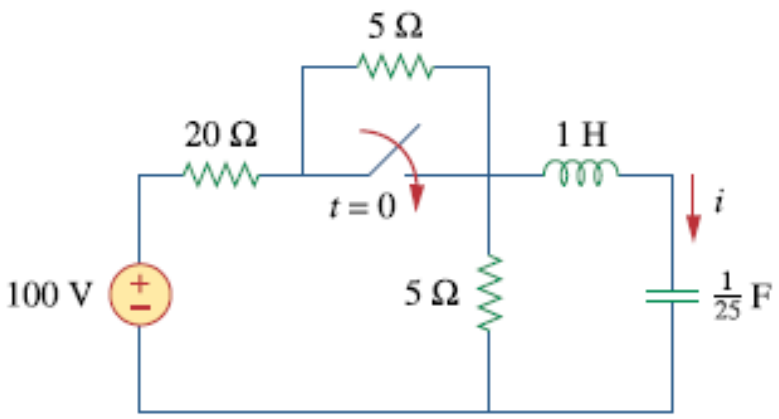
a) Under-damped
b) Over-damped



Q3: The current in a circuit is defined as $\mathbf{d^2i(t)/dt^2 + 4di(t)/dt + 10i(t) = 0}$.

a) Find the characteristic equation [2]
b) What type of damping occurs in the circuit (with reasoning)? Draw its rough sketch. [3]
c) Calculate i(t); i(0)=1 and di(0)/dt=2. [5]

Q4: The circuit is in a steady state before the switch is closed at t=0. Find i(t) for t>0. [15]

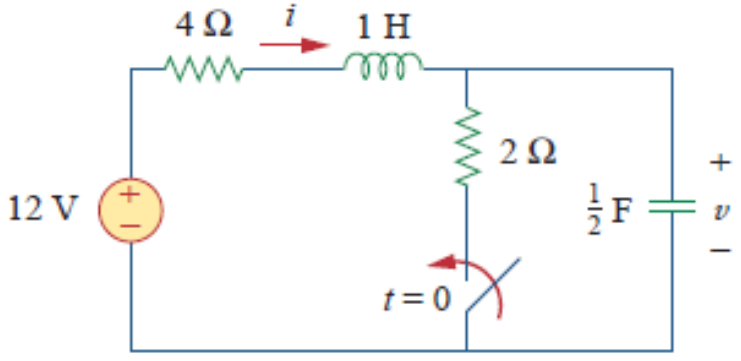


Q5: Solve the differential equations given below: [5+5]

a) $2(d^3i/dt^3) + 9(d^2i/dt^2) + 13(di/dt) + 6i = 0$
Where $i(0^+)=0$, $di/dt=1$ at $t=0^+$
And $d^2i/dt^2 = -1$ at $t = 0^+$.

b) $d^2i/dt^2 + 3(di/dt) + 2i = 10\sin(10t)$
where $i(0^+)=1$ and $di/dt\ (0^+) = -1$.

Q6: Find the complete response *v(t)* and then *i(t)* for t > 0 in the circuit given below [10]



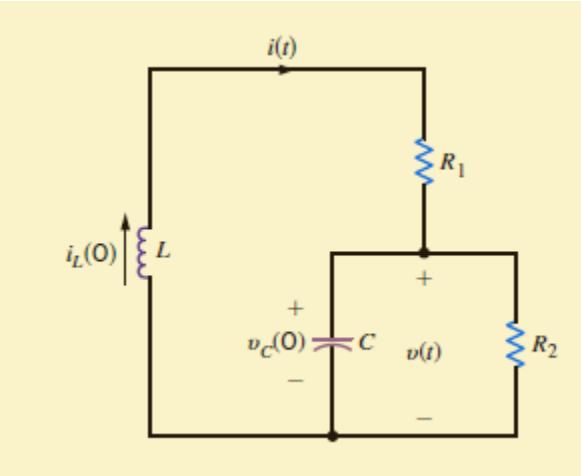
Q7: The two equations that describe the given network are: [15]

a) $L\, di(t)/dt + R_1 i(t) + v(t) = 0$
b) $C\, dv(t)/dt + v(t)/R_2 = i(t)$

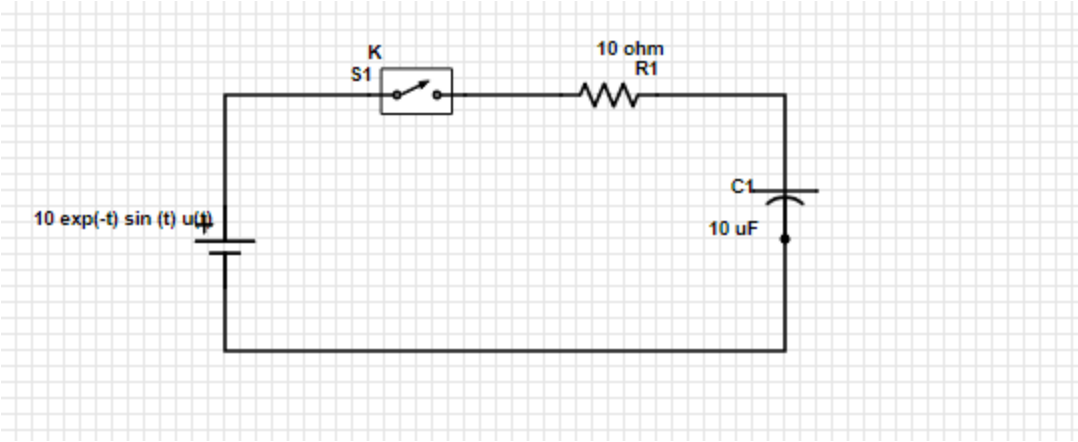
Find expressions for i(t) and v(t)

R_1= 10 ohm , R2= 8 ohm, C=1/8 F, L = 2 H, $v_c(0)$=1 V, $i_L(0)$=0.5 A

NOTE: THIS IS A **VERY** TRICKY QUESTION



Q8: In the network given below, the switch K is closed at t=0 with the capacitor initially uncharged. Find i(t) for t>0. [10]



Q9: For the circuit given below, find it's: [5]

a) Resonant Frequency
b) Bandwidth
c) Quality Factor

Where R=2 ohm, L= 1 mH, C=0.4 uF.

Note: Give units and don't write the answers directly!