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FAKULTI KEJURUTERAAN ELEKTRIK

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SKEU 3741

ELECTROTECHNIC LABORATORY

(Experiment 2)

R – *L* and *R-C* SERIES CIRCUIT TRANSIENT

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I. PRELIMINARY EXERCISE for RL Circuit

Important Note: ***You are required to do this exercise BEFORE the lab session***

Given value R=4 kΩ, 6 kΩ, 8 kΩ, L=400mH and V_S=5V, determine $V_R(t)$ at t = τ, 2τ, and 3τ (τ =L/R) for several value of R.

For the circuit in Figure 1.0:

a) Derived equation $V_R(t) = V_S(t)\,(1 - e^{-(t/\tau)})$
b) Plot the graph of $V_R(t)$ versus t
c) Calculate the theoretical instantaneous current i(t) values for t= t = τ, 2τ,3τ and fill in table 1.0.

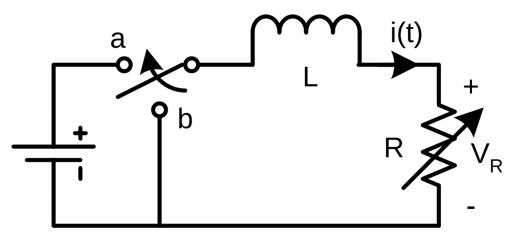

Figure 1.0

For the circuit in Figure 2.0:

a) Derived equation $V_R(t) = V_S(t)\, e^{-(t/\tau)})$
b) Plot the graph of $V_R(t)$ versus t
c) Calculate the theoretical instantaneous current i(t) values for t= t = τ, 2τ,3τ and fill in table 1.0.

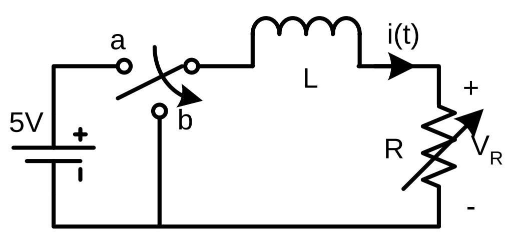

Figure 2.0

Recommended Reference:

Sadiku, Fundamental of Electric Circuit 4th edition,

II. PRELIMINARY EXERCISE for RC Circuit

<u>Important Note:</u> You are required to do this exercise BEFORE the lab session

Given value C=0.05µF, 0.10µF, 0.15µF, R=1kΩ and V_S=5V, determine $V_C(t)$ at t = τ, 2τ, and 3τ (τ =RC) for several value of C.

For the circuit in Figure 3.0:

a) Derived equation $V_C(t) = V_S(t)\,(1 - e^{-(t/\tau)})$
b) Plot the graph of $V_C(t)$ versus t

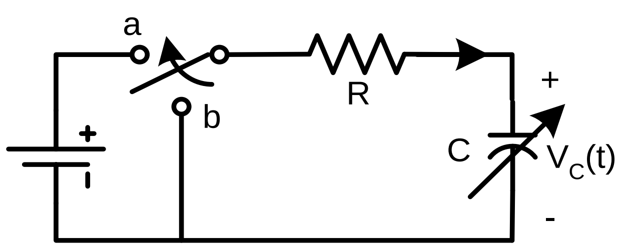

Figure 3.0

For the circuit in Figure 4.0:

c) Derived equation $V_C(t) = V_S(t)\, e^{-(t/\tau)})$
d) Plot the graph of $V_C(t)$ versus t
e) Calculate the theoretical instantaneous current i(t) values for t= t = τ, 2τ,3τ.

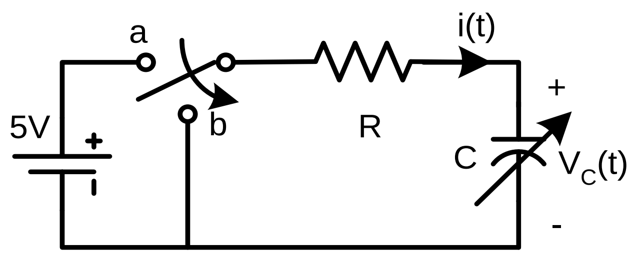

Figure 4.0

<u>Recommended Reference:</u>

Sadiku, Fundamental of Electric Circuit 4th edition,

III. EXPERIMENT:

'*R*- *L* and *R*-*C* Series Circuit Transients'

1. Aims:

i. To investigate the current time response in RL and voltage time response in RC circuit.
ii. To identify the relationship between time constant and the current/voltage in percentage variation.
iii. To observe the current time response with the variations of resistance in RL circuit and voltage with the variation of capacitance in RC circuit.

2. Equipments:

i. Signal generator
ii. Oscilloscope
iii. Decade inductance (L)
iv. Decade resistance (R)
v. Decade capacitance/condenser (C)

3. Procedure:

***Precaution**: Ensure that the 'earth' connections of the oscilloscope probe are at the same earth point (point 'b' in Figure 5.0 and Figure 6.0). Failure to observe this will damage the oscilloscope.*

PART 1

a) Turn ON the oscilloscope and calibrate it.

b) Set the oscilloscope at a full scale current/ voltage waveform of the resistor. The oscilloscope screen is just like a graph paper where the vertical axis is for the voltage and the horizontal axis is for time. The vertical axis scale can be change using the 'volt / div' knob and the horizontal axis scale can be changed using the 'time / div' knob.

c) Choose the square waveform at the signal generator output terminal. Adjust the signal generator amplitude so that the peak to peak voltage on the screen is 5 volt. Set the signal generator frequency to 1 kHz and sketch the input waveform in the space provided.

d) Connect the circuit as shown in Figure 5.0.

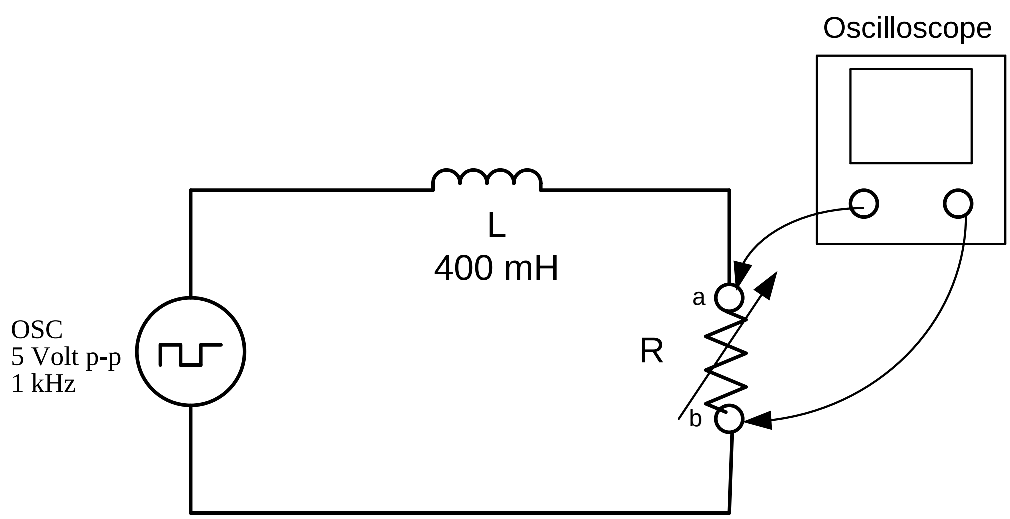

Figure 5.0: RL series circuit

e) From the waveform obtained in the oscilloscope, find the maximum value of V_R for R=4 kΩ, 6 kΩ, 8 kΩ and record it in Table 1.0**.**

f) Record in Table 1.0, the values of voltages across the resistor R at time t = L/R, t = 2(L/R) and t = 3(L/R) for an exponentially increase and an exponentially decay of current.

g) Using the same axis, sketch the waveform including initial and final values obtained for the different values of resistance (4 kΩ, 6 kΩ and 8 kΩ) in the space provided.

PART 2

a) Follow the same procedures in PART 1 from a) to c) to set the voltage waveform of the capacitor.

b) Connect the circuit as shown in Figure 6.0

c) From the waveform obtained in the oscilloscope, find the maximum value of V_C for C=0.05µF, 0.10µF, 0.15µF and record it in Table 2.0**.**

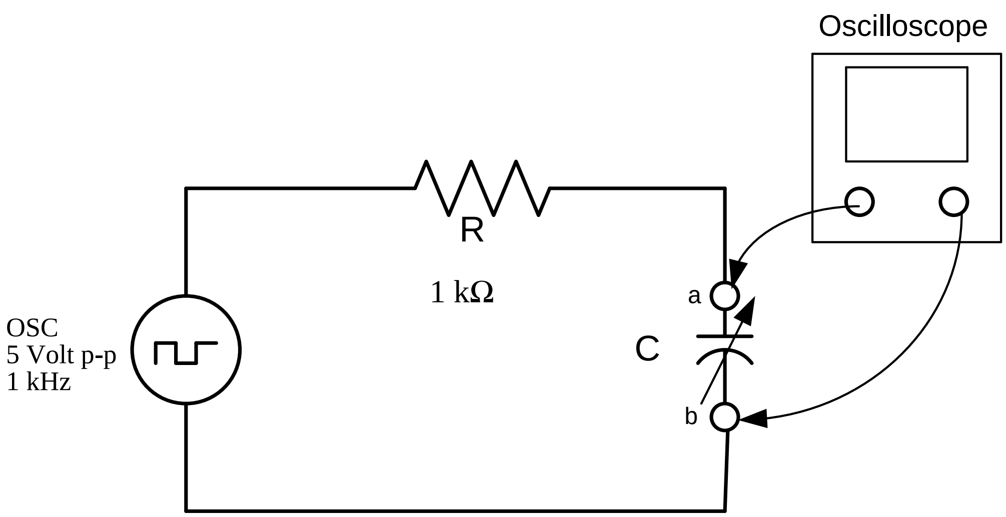

Figure 6.0: RC series circuit

d) Record in Table 2.0, the values of voltages across the capacitor C at time t = RC, t = 2RC and t = 3RC for an exponentially increase and an exponentially decay of voltage.

e) Using the same axis, sketch the waveform including initial and final values obtained for the different values of capacitance (0.05µF, 0.10µF and 0.15µF) in the space provided.