

FACULTY OF ELECTRICAL ENGINEERING	
Course: <b>ELECTRICAL ENGINEERING LABORATORY</b>	Review : 7
Course Code: <b>SEEE 2742</b>	Release Date : <b>October 2023</b>
	Last Amendment : <b>September 2023</b>
	Procedure Number : <b>PK-UTM-FKE-(O)-08</b>



**FACULTY OF ELECTRICAL ENGINEERING  
UNIVERSITI TEKNOLOGI MALAYSIA**

**SEEE 2742  
ELECTROTECHNICS LABORATORY  
EXPERIMENT 4  
RLC SERIES TRANSIENT CIRCUIT**

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### I. PRELIMINARY EXERCISE (10 marks)

***Important Note:*** Students are required to do this exercise **BEFORE** the laboratory session.

- i. Briefly discuss three types of responses in a series RLC circuit. Write down the conditions for the three responses in terms of the *neper frequency*,  $\alpha$ , and undamped natural frequency (or resonant frequency),  $\omega_o$ . Use 150 Hz for the function generator.
- ii. A series RLC circuit is connected to a voltage source that steps from 0 V to 5 V at  $t = 0$  s. The values of L and C are 100 mH and 0.1  $\mu$ F respectively, while R ranges from 200  $\Omega$  to 5 k $\Omega$ . Assume zero initial conditions.
  - a. Write down the expression of the voltage across the capacitor for the three types of responses (for the three different values of R).
  - b. Verify your answers in (a) using *PSpice* or MATLAB or *LTSpice* or *Multism*. You need to demonstrate this to the lab instructor during the lab session.

***Important Note:*** Students are required to bring their laptop to **VERIFY** all simulation results. Students are required to bring a **USB drive** to capture output from the **oscilloscope**.

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## II. EXPERIMENT:

### ‘RLC Series Transient Circuit’

**IMPORTANT: Students need to complete the PRELIMINARY EXERCISE before the laboratory session.**

#### 1. Aims:

To construct and study the type of responses in a series RLC circuit.

#### 2. Equipment:

A signal generator, an oscilloscope, a decade resistor box, a decade inductor box and a decade capacitor box

#### 3. Instructions:

##### Precaution:

- *Ensure that the ground of the oscilloscope probes is connected to the same point and also connected to the negative terminal of the signal generator. Failure to follow this will damage the oscilloscope.*
- *Ask your lab instructor to check your circuit connection before you start the experiment.*

- i. Design a series RLC circuit using the available equipment to produce the undamped natural frequency,  $\omega_o$ , of 7161 rad/s for the THREE types of responses. Set the value of L to 150 mH, and you need to choose the suitable values of C and R.
- ii. Using the oscilloscope, save and print the voltage waveform across the capacitor for the three different types of responses. For the underdamped response, obtain the natural damping frequency,  $\omega_d$ , from the waveform.
  - a. Simulate the series RLC circuits that you have designed in step (i). Compare the simulation results with the experimental results.

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- b. Your short report should contain the following discussion:
- i. The selections of parameters (C and R) to obtain the three types of responses.
  - ii. Waveforms of the capacitor voltage that you have saved using the oscilloscope (for the three types of responses).
  - iii. Comparison between the experimental and simulation results – explain the reasons for the differences.