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**American International University- Bangladesh (AIUB)**

**Department of Electrical and Electronic Engineering (EEE)**

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| --- | --- | --- | --- |
| **Course Name:** | Introduction to Electrical Circuits (IEC) Lab | **Course Code:** | COE 2102 |
| **Semester:** | Fall 2024-25 | **Sec:** | E |
| **Faculty:** | S M Tanvir Hassan Shovon |  | |

|  |  |
| --- | --- |
| **Task:** | Perform Open End Lab following given instructions. |
| **Experiment title:** | Application of KCL and KVL in the Analysis of an AC R-L-C Circuit with Series-Parallel Configuration |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl #** | **ID Number** | **Name** | **Marks in Demonstration** | **Marks in Report** |
| 1. | 22-49059-3 | Shaharia Hasan Jetul |  |  |

**Marking Rubrics (to be filled by Faculty)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Objectives** | **Unsatisfactory (0-1)** | **Good (2-3)** | **Excellent (4-5)** | **Marks** |
| **Reports (10)** | **Identify experiment goals** | Cannot identify goals | Can identify some goals but unable to draw adequate hypothesis | Can identify necessary and  sufficient goals |  |
| **Setup of experiment** | Cannot setup experiment without support | Can setup some of the portions of  experiment without support | Can setup the whole experiment  without support |  |
| **Take organized and accurate measurement** | Cannot take measurements | Can take measurements but inaccurately | Can take organized and accurate  measurements |  |
| **Summarize findings and compare actual to expected results** | Cannot summarize or compare findings to expected results | Summarize finding in an incomplete way | Summarize finding in a complete way |  |
| **Demonstration (10)** | **Observation 1** | Cannot explain hardware related to the experimental setup | Can answer some of the hardware related questions | Can answer most or all the questions |  |
| **Observation 2** | Cannot demonstrate the experimental operation and data collection | Can show some of the experiments | Can answer most or all the operations |  |
| **Observation 3** | Unexpected experimental outcome between calculated, simulated, and experimented data | Somewhat unexpected experiment outcome but percentage errors are too high without any specific reason | Accurate data collected from the hardware and simulation and matches with the calculated data, percentage of errors are minimum |  |
| **Observation 4** | Can’t draw a conclusion | Somewhat draw a conclusion | Can explain the conclusion |  |
|  | **Assessed by (Name, Sign, and Date)** | | **Total:** | **Comments** | |

**American International University- Bangladesh**

# Department of Electrical and Electronic Engineering

COE 2102: Introduction to Electrical Circuits (IEC) Laboratory

**Title:**

Application of KCL and KVL in the Analysis of an AC R-L-C Circuit with Series-Parallel Configuration.

# Objective:

# The purpose of this experiment is to validate the behavior of an R-L-C circuit and verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL) in AC circuits. This involves determining voltage and current using nodal analysis in R-L-C series-parallel combination circuits and comparing practical results with simulated or theoretical values. Additionally, the experiment aims to analyze the phase relationship between voltage and current in the R-L-C circuit and construct a complete vector diagram to reinforce the understanding of nodal analysis.

# Equipment:

* Oscilloscope,
* Function generator
* Resistor: 100 Ω - 5 pcs
* Inductor: 6.3 mH
* Capacitor: 4.7 μF and 10 μF,
* Connecting wire,
* Bread board

A diagram of a circuit

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Fig 1: Circuit diagram for Nodal Analysis

Simulation :

A screenshot of a computer

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**Procedure:**

1. The circuit was constructed based on the experience gained from Experiment 10. Channel 1 of the oscilloscope was connected across the function generator, and channel 2 was connected across R2.
2. The amplitude of the input signal was set to 10V peak, the frequency was adjusted to 1 kHz, and a sinusoidal wave shape was selected.
3. The values of and were measured.
4. The phase relationship between the supply voltage V and the node voltage at was determined.
5. Channel 2 of the oscilloscope was connected across R3.
6. The phase relationship between the waves was determined.
7. The values of and were measured.
8. The phase relationship between the supply voltage V and the node voltage at was determined.
9. , and were determined.
10. All the currents found were compared with the theoretical values, and the percentage error was calculated.

**Data Table:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **R5-C1** | **L1-R4** | **R3-C2** | **R1** | **I Total** |
| 17.81mA | 17.47 mA | 69.84 mA | 51.91 mA | 121.363 mA |

Simulation Value

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **R5-C1** | **L1-R4** | **R3-C2** | **R1** | **I Total** |
| 17.81mA | 17.47 mA | 69.84 mA | 51.91 mA | 121.363 mA |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **R5-C1** | **L1-R4** | **R3-C2** | **R1** | **V Total** |
| 1.88V | 1.88V | 7.071V | 5.19V | 7.071V |

Simulation Value

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **R5-C1** | **L1-R4** | **R3-C2** | **R1** | **I Total** |
| 17.81mA | 17.47 mA | 69.84 mA | 51.91 mA | 121.363 mA |

**Practical Values are in Hard copy of the OEL report**

# Conclusion:

* Learnt to place and measure capacitor and inductor.
* Encountered difficulties while conducting the simulation in Multisim.
* Challenges were encountered due to the use of outdated lab equipment, which impacted the efficiency of the experiment.
* Got familiar with the RC,RL And RLC Circuit.

**Reference(s):**

1. Robert L. Boylestad,” Introductory Circuit Analysis”, Prentice Hall, 12th Edition, New York, 2010, ISBN 9780137146666.

2. R.M. Kerchner and G.F. Corcoran, “Alternating Current Circuits”, John Wiley & Sons, Third Ed., New York, 1956.