Title: **RLC Series Circuit** Worksheet: 34

Course: Electrical Applications Unit: Electrical Theory CLO: 3

Name ANSWER KEY Grade 115pts. Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall determine the missing component(s) in a RLC series circuit given other known quantities.
2. Student shall apply trigonometric functions to produce appropriate RLC series circuit quantities.

**Assessment**

Students shall demonstrate a comprehension of the objectives listed above by scoring a minimum of 75% on this Worksheet. Grading shall be based on an answer key.

**Theory**

A resistive-inductive-capacitive (RLC) series circuit is one that shares the same current through both the resistive, inductive and capacitive components within the circuit. Since there is the existence of the impedance, both inductive and capacitive, there shall also be a voltage and a power triangle.

|  |  |
| --- | --- |
| Impedance Opposition to current flow | Current Response Same current thru each component |
|  |  |
|  |  |
| Voltage Response Total voltage is the vector sum | Power Triangle Presence of Reactive Power |
|  |  |
|  |  |

**Circuit**



|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E |
| R1 | 372.93mW | | 17.629mA | | 1.2kΩ | 21.155V |
| L1 | 214.792mVARL | | 17.629mA | | 691.15Ω | 12.184V |
| C1 | 449.649mVARC | | 17.629mA | | 1.447kΩ | 25.506V |
| Total | 440.72mVA | | 17.629mA | | 1.418kΩ | 25V |
| θ | -32.201˚ | PF | 0.846 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E |
| R1 | 518.957mW | | 20.796mA | | 1.2kΩ | 24.955V |
| L1 | 448.347mVARL | | 20.796mA | | 1.037kΩ | 21.56V |
| C1 | 417.145mVARC | | 20.796mA | | 964.575Ω | 20.059V |
| Total | 519.894mVA | | 20.796mA | | 1.202kΩ | 25V |
| θ | 3.441˚ | PF | 0.998 |

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| --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E |
| R1 | 260.182mW | | 10.412mA | | 2.4kΩ | 24.989V |
| L1 | 112.39mVARL | | 10.412mA | | 1.037kΩ | 10.794V |
| C1 | 104.569mVARC | | 10.412mA | | 964.575Ω | 10.043V |
| Total | 260.299mVA | | 10.412mA | | 2.401kΩ | 25V |
| θ | 1.722˚ | PF | 1.000 |

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| --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E |
| R1 | 214.604mW | | 9.456mA | | 2.4kOhm | 22.695V |
| L1 | 185.405mVARL | | 9.456mA | | 2.073kOhm | 19.607V |
| C1 | 86.251mVARC | | 9.456mA | | 964.575Ohm | 9.121V |
| Total | 236.403mVA | | 9.456mA | | 2.644kOhm | 25V |
| θ | 24.798˚ | PF | 0.908 |

**Circuit**



|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E | |
| R1 | 180.902mW | | 8.682mA | | 2.4kΩ | 20.837V |
| L1 | 156.288mVARL | | 8.682mA | | 2.073kΩ | 18.002V |
| C1 | 36.353mVARC | | 8.682mA | | 482.288Ω | 4.187V |
| Total | 217.048mVA | | 8.682mA | | 2.88kΩ | 25V |
| θ | 33.544˚ | PF | 0.833 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P/Q/S | | I | | R/X/Z | E |
| R1 | 723.606mW | | 17.364mA | | 2.4kΩ | 41.673V |
| L1 | 625.151mVARL | | 17.364mA | | 2.073kΩ | 36.003V |
| C1 | 145.411mVARC | | 17.364mA | | 482.288Ω | 8.374V |
| Total | 868.192mVA | | 17.364mA | | 2.88kΩ | 50V |
| θ | 33.544˚ | PF | 0.833 |

Evaluations

Answer the following questions based on the last configured circuit above.

1. If the frequency is increased, the phase angle?
   1. Increases
   2. Decreases
   3. Stays the same
2. If the voltage is decreased, the power factor will?
   1. Increase
   2. Decrease
   3. Stay the same
3. If the capacitance is increased, the total impedance will?
   1. Increase
   2. Decrease
   3. Stay the same
4. If the resistance is increased, the total current will?
   1. Increase
   2. Decrease
   3. Stay the same
5. If the inductance is decreased, the impedance will?
   1. Increase
   2. Decrease
   3. Stay the same
6. If the frequency is decreased, the active power will?
   1. Increase
   2. Decrease
   3. Stay the same
7. If the voltage is decreased, the reactive power will?
   1. Increase
   2. Decrease
   3. Stay the same