

Steady State Response of Circuits

Spoken Tutorial Project

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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Learning Objectives

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We will study:



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We will study:

- **AC phase shift in:**
RC, RL and LCR Circuits



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We will study:

- **AC phase shift in:**
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- **Calculate Phase shift values**



Learning Objectives

We will study:

- **AC phase shift in:**
RC, RL and LCR Circuits
- **Calculate Phase shift values**
- **Show circuit diagrams**



System Requirement

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- **ExpEYES v 3.1.0**



System Requirement

- **ExpEYES v 3.1.0**
- **Ubuntu Linux OS v 14.10**



Pre-requisites

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- **Basic Physics**

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- **ExpEYES Junior interface**



Pre-requisites

- **Basic Physics**
- **ExpEYES Junior interface**
- **For relevant tutorials, visit our website**
www.spoken-tutorial.org



Steady State Response

Steady State Response

Steady state response,

- is a period of observance when a circuit is in equilibrium condition



Phase Shift

Phase Shift

Phase shift,

- is a relative change in the phase of a waveform



RC Circuit

RC Circuit

- **Study AC phase shift in RC circuit**



AC phase shift

AC phase shift

- **Measure voltage variation and phase shift in the circuit**



Phase Shift

Phase Shift

- $\Phi = \arctan(X_C/X_R)$, $X_C = 1/2\pi * f * C$
- $f = 149.4\text{Hz}$, $C = 1 * 10^{-6}\text{farad}$,
 $X_R = R = 1000\Omega$
- $X_C = 1 \div (2 * 3.142 * 149.4 * 1 * 10^{-6})$
- $X_C = 1065.16$
- $\Phi = \arctan(1065.16 \div 1000)$
- $\Phi = 46.81\text{ deg}$



RL Circuit

RL Circuit

- **Study AC phase shift in RL circuit**



AC phase shift

AC phase shift

- **Measure phase shift when capacitor is replaced by an inductor**



Phase Shift

Phase Shift

- $\Phi = \arctan(X_L/X_R)$, $X_L = 2 * \Pi * f * L$
- $X_L = 2 * 3.142 * 149.4 * (78/1000)$
- $X_L = 73.23$
- *Total resistance* = $(560\Omega + 800\Omega)$
- $\Phi = \arctan(73.23 \div 1360)$
- $\Phi = 3.08 \text{ deg}$



LCR Circuit

LCR Circuit

- **Study AC phase shift in LCR circuit**



AC phase shift

AC phase shift

- **Measure phase shift when inductor and capacitor are connected in the circuit**



Phase Shift

Phase Shift

- $\Phi = \arctan\{(X_C - X_L) \div (X_R)\}$
- $\Phi = \arctan\{(1065.3 - 73.2) \div (1000)\}$
- $\Phi = \arctan(992.1 \div 1000)$
- $\Phi = \arctan(0.9921)$
- $\Phi = 44.77 \text{ deg}$



Summary

- **AC phase shift in:**
RC, RL and LCR Circuits
- **Calculated the Phase shift values**



Assignment

Study AC Phase shift of:

- 1 RL and LCR circuits, using different resistance & capacitance values**



About the Spoken Tutorial Project

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Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- Conducts workshops using spoken tutorials
- Gives certificates to those who pass an online test
- For more details, please write to contact@spoken-tutorial.org



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- More information on this Mission is available at <http://spoken-tutorial.org/NMEICT-Intro>

