Physics

LCR Circuits

V_S

AC Voltage Source

V_C

Capacitor (C)
Units **F**, (farad)

V_R

Resistor (R)
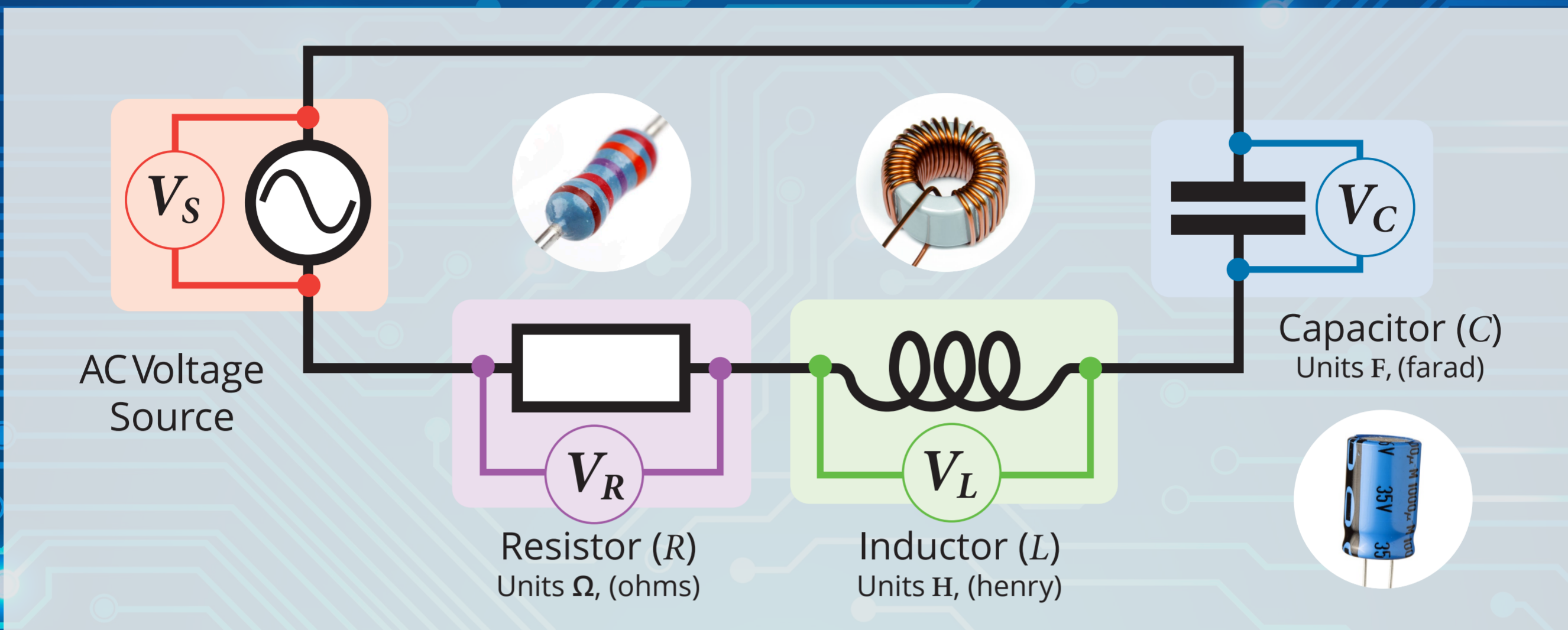Units **Ω**, (ohms)

V_L

Inductor (L)
Units **H**, (henry)

REACTANCE & IMPEDANCE

V_S is an AC voltage with *angular frequency* $\omega = 2\pi f$

INDUCTIVE REACTANCE
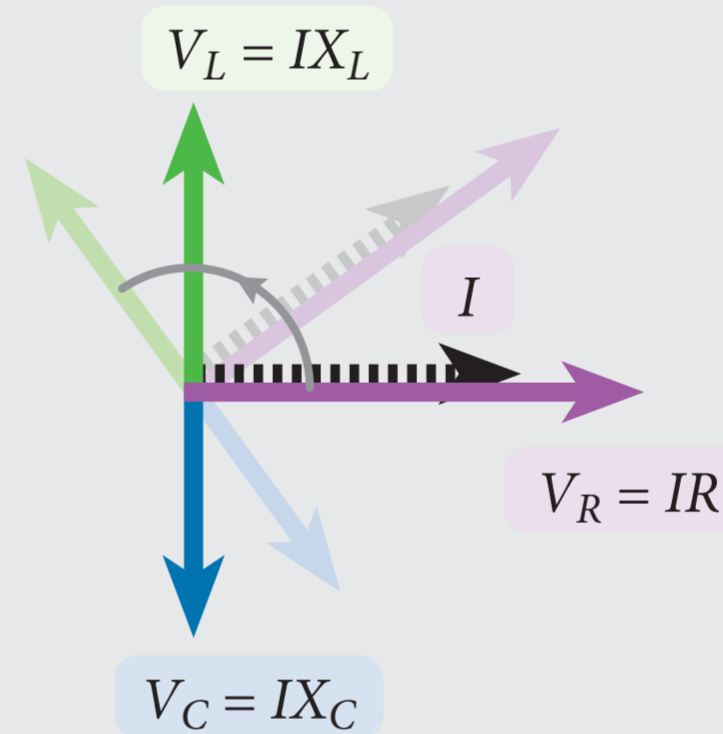
$$X_L = \omega L$$

CAPACITIVE REACTANCE

$$X_C = \frac{1}{\omega C}$$

LCR CIRCUIT IMPEDANCE

$$Z = \sqrt{R^2 + (X_L - X_C)^2}$$

SI unit for Resistance, Reactance, and Impedance is: Ohms [Ω].

VOLTAGE PHASORS

$V_L = IX_L$

I

$V_R = IR$

$V_C = IX_C$

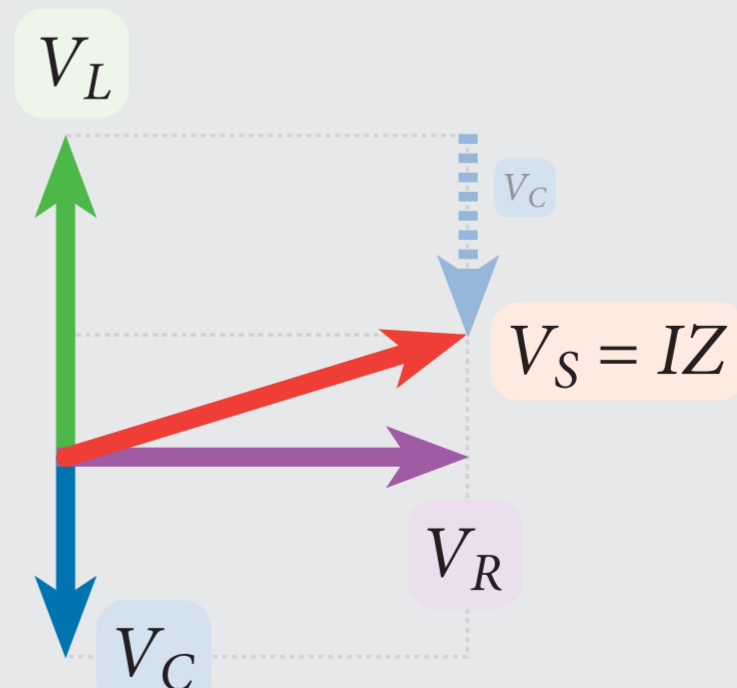Current (I) is same throughout all components in the circuit. V_R-phasor is parallel to the I-phasor.

RESONANCE

Conditions for resonance:

$$V_L = V_C, \; X_L = X_C$$

$$\omega_{RES} = \frac{1}{\sqrt{LC}}$$

Current ➝ Maximum
Impedance ➝ Minimum

SUPPLY VOLTAGE

V_L

V_C

$V_S = IZ$

V_R

V_C

Supply voltage phasor is given by the vector sum of V_R, V_L, and V_C.