1. METRIC TERMS

a. 1,000,000,000 -- Billion - GIGA - G
b. 1,000,000 ---Million - MEGA - M
c. 1,000--- Thousand - Kilo - K
d. $\frac{1}{1,000}$ --Thousandth - MILLI - m
e. $\frac{1}{1,000,000}$ ---Millionth - MICRO - µ
f. $\frac{1}{1,000,000,000}$ --Billionth - NANO - n
g. $\frac{1}{1,000,000,000,000}$ ------------------------------------- Trillionth - PICO - p

2. METRIC CONVERSION SCALE

GIGA	MEGA	KILO	BASE	MILLI	MICRO	NANO	PICO
9	6	3	UNITS	-3	-6	-9	-12

To convert to base units move decimal point →

To convert to base units move decimal point ←

3. Resistor Color Code

Band color and digit represented:

0 Black	4 Yellow	8 Grey	20% no color
1 Brown	5 Green	9 White	
2 Red	6 Blue	5% Gold	
3 Orange	7 Violet	10% Silver	

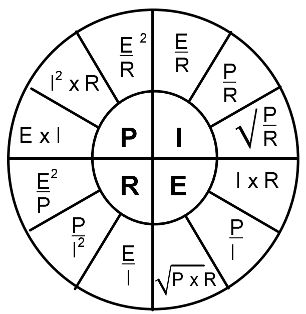
4. DC Circuits

a. OHM's law

$E = IR$

$I = \frac{E}{R}$

$R = \frac{E}{I}$



b. Resistors in series

$R_T = R_1 + R_2 + R_3 + \ldots$
$I_T = I_1 = I_2 = I_3 = \ldots$
$E_T = E_1 + E_2 + E_3 + \ldots$

c. Resistors in parallel

$R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$ … Different value resistors

$R_T = \frac{R}{N}$ Same value resistors

5. SYMBOLS

LETTER SYMBOL	MEANING	UNIT OF MEASURE
E, V	Voltage	Volt
I	Current	Ampere
R	Resistance	Ohm
C	Capacitor	Farad
L	Inductor	Henry
X_C	Capacitive Reactance	Ohm
X_L	Inductive Reactance	Ohm
Z	Impedance	Ohm

6. AC Circuits

a. Conversion of values

$E_{RMS} = 0.707\ E_{PK}$

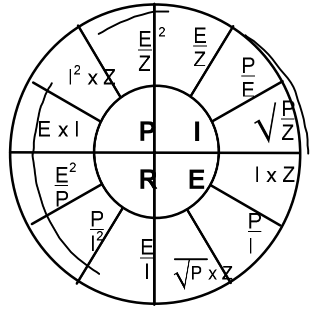
$E_{PK} = 1.414\ E_{RMS}$

b. Series RLC Circuit

$I_T = I_R = I_L = I_C$

$E_T = \sqrt{E_R^2 + (E_L - E_C)^2}$

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



Parallel RLC Circuit

$E_T = E_R = E_L = E_C$

$I_T = \sqrt{I_R^2 + (I_L - I_C)^2}$

$Z = \frac{E_T}{I_T}$

7. Capacitor

a. $X_C = \frac{1}{2\pi fC}$

b. Capacitors in series add like resistors in parallel.

c. Capacitors in parallel add like resistors in series.

8. Inductor

a. $X_L = 2\pi fL$

b. Inductors in series add like resistors in series.

c. Inductors in parallel add like resistors in parallel.

9. Time Constants

a. TC = RC Time it takes a capacitor to charge to 63.2% of applied voltage.

b. TC = $\frac{L}{R}$ Time it takes an inductor to charge to 63.2% of available current.

Where: T = Time constant in seconds
R = Resistance in ohms
C = Capacitance in farads
L = Inductance in henries

5T = Discharge or FULL charge

10. Transformer relationships

a. Voltage turns ratio

$$\frac{N_P}{N_S} = \frac{E_P}{E_S}$$

b. Current turns ratio

$$\frac{N_P}{N_S} = \frac{I_S}{I_P}$$

c. Impedance turns ratio

$$\frac{N_P}{N_S} = \sqrt{\frac{Z_P}{Z_S}}$$

d. Efficiency (%)

$$\text{Eff.} = \frac{\text{output}}{\text{input}} \times 100$$

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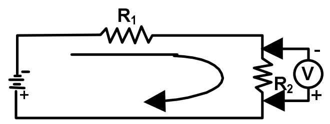
11. SUMMARY OF CHARACTERISTICS OF SERIES AND PARALLEL RESONANT CIRCUITS

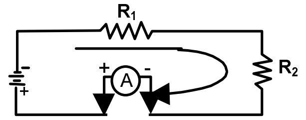
	Series Resonant Circuit	Parallel Resonant Circuit
Reactance (X)	$X_L = X_C$	$X_L = X_C$
Impedance (Z)	Minimum	Maximum
Current (I_T)	Maximum	Minimum
Circuit at Resonance	Resistive	Resistive
Circuit below Resonance	Capacitive	Inductive
Circuit above Resonance	Inductive	Capacitive
Frequency (fr)	$\frac{1}{2\pi\sqrt{LC}}$	$\frac{1}{2\pi\sqrt{LC}}$
Quality (Q) of Circuit	$\frac{X_L}{R}$	$\frac{X_L}{R}$
Bandwidth (BW)	$\frac{fr}{Q}$	$\frac{fr}{Q}$

12. USING METERS

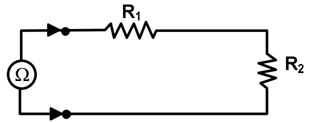
a. Measuring voltage: Observe polarity and connect meter across component or source.



b. Measuring current: Open circuit, observe polarity, and connect meter into the circuit.



c. Measuring resistance: Disconnect power source, connect meter across circuit or component- no polarity.



13. ANTENNA LENGTH

Formulas assume velocity of propagation equal 95% of the velocity of light

$L\ (ft) = \frac{468}{fMHz}$ (for half-wave antenna)

$L\ (ft) = \frac{234}{fMHz}$ (for quarter-wave antenna)

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DC/AC FORMULA DATA

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