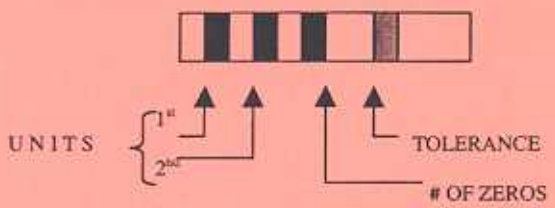
ELECTRONIC FORMULAS

USAOMMCS X - 6238 REV JAN 2002

RESISTOR COLOR CODE



0 BLACK	6 BLUE
1 BROWN	7 VIOLET
2 RED	8 GREY
3 ORANGE	9 WHITE
4 YELLOW	5% GOLD
5 GREEN	10% SILVER
	20% NO COLOR

THIRD COLOR BAND INDICATES NUMBER OF ZEROS TO BE *ADDED* AFTER FIGURES GIVEN BY FIRST TWO COLOR BANDS. BUT IF THIRD COLOR BAND IS GOLD, MULTIPLY BY 0.1 AND IF SILVER, MULTIPLY BY 0.01. DO NOT CONFUSE WITH FOURTH COLOR BAND THAT INDICATES TOLERANCE. THUS, A RESISTOR MARKED IN BLUE, RED, GOLD, GOLD HAS A RESISTANCE OF 6.2 OHMS AND A TOLERANCE OF 5%

FILM RESISTOR TOLERANCES

G = ± 2%

J = ± 5%

K = ± 10%

M = ± 20%

ELECTRICAL FORMULAS

1. OHM'S LAW FORMULA FOR DC CIRCUITS

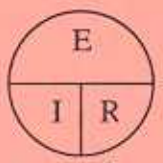
a. SYMBOLS

E = VOLTAGE IN *VOLTS*

I = CURRENT IN *AMPERES*

R = RESISTANCE IN *OHMS*

b OHM'S LAW



$E = IR = I = \sqrt{PR}$

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

$R = \frac{E}{I} = \frac{E^2}{P} = \frac{P}{I^2}$

$P = I^2R = \frac{E^2}{R} = EI$

2. RESISTANCE IN SERIES

$R_T = R_1 + R_2 + R_3 + R_4 \ldots$

3. RESISTANCE IN PARALLEL GENERAL FORMULA

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$ OR

$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \ldots\ldots}$

2 RESISTORS ONLY $R_T = \frac{R_1 \times R_2}{R_1 + R_2}$

EQUAL RESISTORS ONLY $R_T = \frac{R_1}{N}$

SPECIAL FORMULAS

1. FREQUENCY (f) :

$f = \frac{1}{2\pi\sqrt{LC}}$

2. EFFICIENCY:

$\%\ EFF = \frac{OUTPUT}{INPUT} \times 100$

3. TRANSFORMER RELATIONSHIPS

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

N = NUMBER OF TURNS

P = PRIMARY

S = SECONDARY

4. TIME CONSTANT:

$TC = RC \text{ OR } \frac{L}{R}$

5. GAIN = $\frac{E_{OUT}}{E_{IN}}$

6. QUALITY = $\frac{f_R}{B.W.}$

B.W. = BAND WIDTH

F_R = RESONANT FREQUENCY

7. PERIOD: $P = \frac{1}{f}$

FREQUENCY:

$f = \frac{1}{P}$

PULSE WIDTH:

$PW = \frac{1}{2f}$

ELECTRONIC FORMULAS

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AC FORMULAS

1. SYMBOLS

C = CAPACITANCE IN *FARADS*

L = INDUCTANCE IN *HENRIES*

X_C = CAPACITIVE REACTANCE IN *OHMS*

X_L = INDUCTIVE REACTANCE IN *OHMS*

Z = IMPEDANCE IN *OHMS*

F = FREQUENCY IN *Hz*

2. VOLTAGE & CURRENT RELATIONSHIP

a. RESISTORS IN PHASE

b. CAPACITOR I LEADS E

c. INDUCTOR E LEADS I

3. CAPACITANCE

a. CAPACITANCE IN SERIES COMPUTED AS RESISTORS IN PARALLEL

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots\ldots$$

b. CAPACITANCE IN PARALLEL IS COMPUTED AS RESISTORS IN SERIES

$$C_T = C_1 + C_2 + C_3 + \ldots$$

4. CAPACITIVE REACTANCE

$$X_C = \frac{1}{2\pi f C} \qquad C = \frac{1}{2\pi f X_C}$$

a. REACTANCE OF CAPACITORS IN SERIES, COMPUTED AS RESISTORS IN SERIES

$$X_{CT} = X_{C1} + X_{C2} + X_{C3} + \ldots.$$

b. REACTANCE OF CAPACITORS IN PARALLEL, COMPUTED AS RESISTORS IN PARALLEL

$$\frac{1}{X_{CT}} = \frac{1}{X_{C1}} + \frac{1}{X_{C2}} + \frac{1}{X_{C3}} + \ldots.$$

5. INDUCTANCE

a. INDUCTANCE IN SERIES COMPUTED AS RESISTORS IN SERIES

$$L_T = L_1 + L_2 + L_3 + \ldots.$$

b. INDUCTANCE IN PARALLEL COMPUTED AS RESISTORS IN PARALLEL

$$\frac{1}{L_T} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \ldots..$$

6. INDUCTIVE REACTANCE

$$X_L = 2\pi f L \qquad L = \frac{X_L}{2\pi f}$$

a. REACTANCE OF INDUCTORS IN SERIES IS COMPUTED AS RESISTORS IN SERIES

$$X_{LT} = X_{L1} + X_{L2} + X_{L3} + \ldots..$$

b. REACTANCE OF INDUCTORS IN PARALLEL IS COMPUTED AS RESISTORS IN PARALLEL

$$\frac{1}{X_{LT}} = \frac{1}{X_{L1}} + \frac{1}{X_{L2}} + \frac{1}{X_{L3}} + \ldots.$$

7. IMPEDANCE

a. SERIES CIRCUIT

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

Z = R WHEN $X_L = X_C$

b. PARALLEL CIRCUIT

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

Z IS MAXIMUM WHEN $X_L = X_C$

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

8. SERIES AND PARALLEL RESONANCE

a. SERIES

CURRENT IS MAXIMUM

VOLTAGE ACROSS L OR C MAY BE MANY TIMES LINE VOLTAGE

b. PARALLEL

LINE CURRENT MINIMUM

TANK CURRENT MAXIMUM

c. FORMULA

$$f = \frac{1}{2\pi\sqrt{LC}}$$

9. SINUSODIAL VOLTAGE & CURRENT

a. EFFECTIVE VALUE = 0.707 X PEAK VALUE

b. AVERAGE VALUE = 0.637 X PEAK (FULL WAVE) 0.318 X PEAK (HALF WAVE)

c. PEAK VALUE = 1.414 X EFFECTIVE VALUE

d. EFFECTIVE VALUE = 1.11 X AVERAGE VALUE

e. AVERAGE VALUE = 0.9 X EFFECTIVE VALUE

f. MULTIMETERS READ EFFECTIVE VALUE

g. EFFECTIVE VALUE = RMS VALUE