USING ETA® INTERNATIONAL COMMON FORMULAS

For use on all Basic Electronics Exams as well as the General Communications Technician-Level 1 (GCT1) Exam

**Conversion Factors**

<table>
<thead>
<tr>
<th>Formula</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\pi) (Pi)</td>
<td>3.14</td>
</tr>
<tr>
<td>2(\pi)</td>
<td>6.28</td>
</tr>
<tr>
<td>(\log_{10}\pi)</td>
<td>0.497</td>
</tr>
<tr>
<td>1 meter</td>
<td>3.28 feet</td>
</tr>
<tr>
<td>1 inch</td>
<td>2.54 cm</td>
</tr>
<tr>
<td>1 radian</td>
<td>57.3°</td>
</tr>
</tbody>
</table>

**Resonant Frequency Formulas**

Where \(f\) is in kHz, \(L\) is in microhenries, \(C\) is in microfarads

\[ f_{res} = 159.2 \frac{1}{\sqrt{LC}} \]

Where \(f\) is in Hz, \(L\) is in Henries, \(C\) is in Farads

\[ f_{res} = \frac{1}{2\pi \sqrt{LC}} \]

**Frequency & Wavelength Formulas**

\[ f = \text{frequency}, \quad \lambda = \text{wavelength} \]

0.5\(\lambda\) = 180° = half wave and 0.25\(\lambda\) = 90° = quarter wave

\[ f_{w} = \frac{(3 \times 10^{4})}{\lambda_{\text{micro}}} \quad \text{or} \quad f_{\text{max}} = 984 / \lambda_{\text{w}} \]

\[ \lambda_{\text{micro}} = \frac{(3 \times 10^{6})}{f_{w}} \quad \text{or} \quad \lambda_{\text{w}} = 984 / f_{\text{max}} \]

\[ c = f \times \lambda \quad \text{where} \quad c \text{ is the speed of light} \]

**Sine Wave Conversion**

- Effective value (RMS) = 0.707 x Peak Value = 1.11 x Average Value
- Peak Value = 1.414 x Effective Value (RMS) = 1.57 x Average Value
- Average Value over positive half period = 0.637 x Peak Value = 0.9 x Effective Value (RMS)
- Identify: Waveform, Peak (amplitude), RMS, 1 cycle over time period (frequency), Peak to peak, and practical average

**Voltage Gain In Decibels**

Gain dB = 20\log (V_{\text{out}} / V_{\text{in}})

**Ratio Of 2 Power Levels In Decibels**

Gain dB = 10\log_{10} (P_{2} / P_{1})

**Resistors In Series**

\[ R = R_{1} + R_{2} + R_{3} + ... \]

**Resistors In Parallel**

\[ \frac{1}{R} = \left(\frac{1}{R_{1}} + \frac{1}{R_{2}} + \frac{1}{R_{3}} + ...\right) \]

**Inductors Connected In Series**

\[ L = L_{1} + L_{2} + L_{3} + ... \]

**Inductors Connected In Parallel**

\[ \frac{1}{L} = \left(\frac{1}{L_{1}} + \frac{1}{L_{2}} + \frac{1}{L_{3}} + ...\right) \]

**Reactance Of Inductors**

\[ XL = \frac{2\pi f L}{\lambda} \]

Where \(f\) is in kHz, \(L\) is in microhenries, \(C\) is in microfarads

**Time Constants**

\[ T (\text{Greek Tau}), \quad R (\text{ohms}), \quad C (\text{Farads}), \quad L (\text{Henries}) \]

RL circuit: \( T (\text{sec}) = L (\text{H}) / R (\Omega) \)

RC circuit: \( T (\text{sec}) = R (\Omega) \times C (\text{F}) \)

**Compute Charge Or Quantity of Electricity**

where \(Q\) is the charge (in Coulombs), \(C\) is the capacitance (in Farads), and \(V\) is the potential difference (in Volts)

\[ Q = C \times V \]

**Energy Storage In A Capacitor**

where \(W\) is the energy (in Joules), \(C\) is the capacitance (in Farads), and \(V\) is the potential difference (in Volts)

\[ W = \frac{1}{2} \times C \times V^{2} \]

**Capacitors Connected In Parallel**

\[ C = C_{1} + C_{2} + C_{3} + ... \]

**Capacitors Connected In Series**

\[ \frac{1}{C} = \left(\frac{1}{C_{1}} + \frac{1}{C_{2}} + \frac{1}{C_{3}} + ...\right) \]

**Impedance Of Capacitors**

\[ X_{c} = \frac{1}{(2 \pi f x C)} \]

**Impedance For A Series Circuit**

where \(Z\) is impedance

\[ Z = \sqrt{R^{2} + (X_{1} - X_{2})^{2}} \]

**Impedance For R And X In Parallel**

\[ RX \quad Z = \frac{R}{\sqrt{R^{2} + X^{2}}} \]

**Battery Internal Resistance**

\[ V_{\text{out}} = \text{EMF} - (R_{\text{int}} \times I_{\text{out}}) \]

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