# Zero to Advanced Formula Sheet

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| **Lesson 1** | $I = \frac{E}{R}$<br>**Ohm's Law** | | | |
| **Lesson 2** | $P = IE = I^2R = \frac{E^2}{R}$<br>**Electric Power** | W = J x t<br>1 kWh = 3.6 MJ<br>**Electric Energy** | Second, Metre, Kilogram, Ampere, Kelvin, Mole and Candela.<br>**SI Seven Base Units** | V = $\frac{J}{Q}$ A = $\frac{Q}{t}$<br>W = $\frac{J}{t}$ R = $\frac{E}{I}$<br>**SI Derived Units** |
| **Lesson 3** | $Rt = R1 + R2 + R3 \ldots n$<br>**Resistors In Series** | $\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} \ldots n$<br>**Resistors In Parallel** | Better Be Ready Or Your Great Big Venture Goes West<br>**Resistor Colour Code** | |
| **Lesson 4** | The sum of all currents entering and exiting a node must equal zero.<br>**Kirchoff Current Law (KCL)** | All voltages across components in a loop must equal the sum of the input voltage.<br>**Kirchoff Voltage Law (KVL)** | Current into a node +<br>Current out of a node –<br>**Nodal Analysis** | |
| **Lesson 5** | Right hand for generators.<br>Left hand for motors.<br>**Fleming's Rules** | $E_{int} = E_{Peak}Sin\theta^0$<br>**Instantaneous Value** | $V_{rms} = V_{peak} \times 0.707$<br>**Root Mean Square value** | Av = 0.637 x Peak<br>**Average Value** |
| | $\lambda = c/f$<br>**Frequency Wavelength** | $Period = \frac{1}{Freq}$<br>**Frequency Period** | $c = 300\ x10^6$ m/s<br>**Speed of Light** | $\frac{V_p}{V_S} = \frac{I_S}{I_P} = \frac{N_p}{N_S} = \sqrt{\frac{Z_P}{Z_S}}$<br>**Transformers** |

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| **Lesson 6** | $C = \frac{\varepsilon \text{ x A}}{d}$<br>**Capacitor**<br>ε0 = 8.854x10-12 F/m | Q = C x E<br>**Capacitor Charge** | $W = \frac{E^2 x\ C}{2}$<br>**Capacitor Energy** | $\frac{1}{Ct} = \frac{1}{C1} + \frac{1}{C2} + \frac{1}{C3} \ldots n$<br>**Capacitors In Series** |
| | $Ct = C1 + C2 + C3 \ldots n$<br>**Capacitors In Parallel** | $H = \frac{0.4\ x\ \pi\ x\ N\ x\ I}{\varepsilon}$<br>**Inductor** | $W = \frac{I^2\ x\ L}{2}$<br>**Energy in Inductor** | $Lt = L1 + L2 + L3 \ldots n$<br>**Inductors In Series** |
| | $\frac{1}{Lt} = \frac{1}{L1} + \frac{1}{L2} + \frac{1}{L3} \ldots n$<br>**Inductors In Parallel** | | | |
| **Lesson 7** | $T = CR = \frac{L}{R}$<br>**RC RL Time Constant** | $X_l = 2\pi fL$<br>**Inductive Reactance** | $X_c = \frac{1}{2\pi fC}$<br>**Capacitive Reactance** | $f_r = \frac{1}{2\pi\sqrt{LC}}$<br>**Tuned Circuit Freq** |
| | $Q = \frac{2\pi fL}{R} = \frac{1}{2\pi fCR}$<br>**Q of tuned Circuit** | $BW = \frac{f_{Resonant}}{Q}$<br>**Tuned Circuit Band Width** | $Z = \sqrt{R^2} + (X_L - X_C)^2$<br>**Impedance** | |
| **Lesson 8** | $Power\ Gain = 10Log_{10} \times \frac{P_1}{P_2}$<br>**Power Gain dB** | $Voltage\ Gain = 20Log_{10} \times \frac{E_1}{E_2}$<br>**Voltage Gain dB** | $\beta = \frac{\Delta I_c}{\Delta I_b}$<br>**Transistor Beta Gain** | $\alpha = \frac{\Delta I_C}{\Delta I_E}$<br>**Transistor Alpha Gain** |
| | $\mu = \frac{\Delta E_b}{\Delta E_e}$<br>**Valve Gain** | | | |

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| **Lesson 9** |  <br>E Peak = 1.4 x E RMS<br>E AV = 0.45 x E RMS<br>E PRV = 1.4 to 2.8 E RMS<br>Ripple = 50 Hz<br>**Half Wave** |  <br>E Peak = 1.4 x E RMS<br>E AV = 0.9 x E RMS<br>E PRV = 2.8 E RMS<br>Ripple = 100 Hz<br>**Full Wave** |  <br>E Peak = 1.4 x E RMS<br>E AV = 0.9 x E RMS<br>E PRV = 1.4 x E RMS<br>Ripple = 100 Hz<br>**Bridge** | $C = \frac{I\ x\ t}{E}$<br>**Filter Capacitor** |
| **Lesson 10** | $E_n = \sqrt{4\ x\ K\ x\ T\ x\ R\ x\ BW}$<br>K = $1.381 \times 10^{-23}$<br>**Thermal Noise** | $Image = signal + (2\ \times IF)$<br>**Superheterodyne Image** | | |
| **Lesson 11** | $m = \frac{\Delta f}{f_S}$<br>**FM Modulation Index** | $BW = 2(\Delta_f + f_s)$<br>**FM Band Width** (Carson's Rule) | $m = \frac{M}{A}$<br>**AM Modulation Index** | |
| **Lesson 12** | $Z_O = \sqrt{(Z_{SC}\ x\ Z_{OC})}$<br>**Impedance Matching** | $VSWR = \frac{V_{max}}{V_{min}}$<br>**VSWR** | $VSWR = \frac{V_{fwd} + V_{ref}}{V_{fwd} - V_{ref}}$<br>**VSWR** | $SWR = \frac{1 + \sqrt{\frac{P_{ref}}{P_{fwd}}}}{1 - \sqrt{\frac{P_{ref}}{P_{fwd}}}}$<br>**Standing Wave Ratio Power** |
| | $\frac{N_P}{N_S} = \sqrt{\frac{Z_P}{Z_S}}$<br>**Balun** | | | |
| **Lesson 13** | $ERP = power\ x\ gain\ (linear)$<br>**Effective Radiated Power** | EIRP (W) = 1.64 x ERP (W)<br>**EIRP Watts** | EIRP (dB) = ERP (dB) + 2.15dB<br>**EIRP dB** | $v = f\ x\ \lambda$<br>**Propagation Velocity** |
| **Lesson 14** | $SNR = 10Log\ \frac{Signal\ Power}{Noise\ Power}$<br>**Signal to Noise ratio** | $SNR = 20Log\ \frac{Signal\ Voltage}{Noise\ Voltage}$<br>**Signal to Noise ratio** | | |