SKILLED TRADES BC

NOTE Do **not** bring this document to your exam.
These formulas will be included in the exam reference materials.

Formula Sheet

General		
$A = L \bullet W$	$A = \pi r^2$	
$W = 0.5LI^2$	$W = 0.5CE^2$	
$Cos\Theta = \frac{adj}{hyp}$	$Sin\Theta = \frac{opp}{hyp}$	$Tan\Theta = \frac{opp}{adj}$
$I = \frac{E}{R}$	$C = \frac{Q}{V}$	
$P = IE$	$P = I^2R$	$P = \frac{E^2}{R}$
$C = \frac{8.85X10^{-12} \bullet K \bullet A}{d}$	$F_m = \frac{k \bullet I_1 \bullet I_2}{d^2}$	$F = \frac{k \bullet Q_1 \bullet Q_2}{d^2}$
$R = \frac{KL}{cma}$ Cu=10.4 Ω/milfoot, Al=17 Ω/milfoot *(Imperial)*	$R = \frac{\rho \ell}{A}$ Cu=1.72×10^{-8} Ω/m, Al=2.65×10^{-8} Ω/m *(SI)*	
$R_{change} = R_{old} \bullet \alpha \bullet \Delta t$ *(Cu=0.00393, Al=0.004)*		
$\Phi = \frac{F_M}{R_M}$	$\beta = \frac{\Phi}{A}$	$\mu = \frac{\beta}{H}$
$H = \frac{F_M}{L}$		
$\tau = \frac{L}{R}$	$\tau = RC$	
$x_l = 2\pi f L$	$x_c = \frac{1}{2\pi f C}$	$Z = \sqrt{R^2 + {X_{net}}^2}$ (series only)
$Z = \frac{1}{\sqrt{\left(\frac{1}{R}\right)^2 + \left(\frac{1}{Xl} - \frac{1}{Xc}\right)^2}}$		
$E = Blv$	$L = \frac{N^2 \mu A}{\ell}$	$E = -L\frac{\Delta I}{\Delta t}$ and $E = -M\frac{\Delta I}{\Delta t}$
$e_{INST} = E_P \times Sin\,\Theta$	$f = \frac{1}{p}$	
$f_r = \frac{1}{2\pi\sqrt{LC}}$	$L = \frac{\left(\frac{1}{2\pi fr}\right)^2}{C}$	$C = \frac{\left(\frac{1}{2\pi fr}\right)^2}{L}$
(VA) $S_{3\Phi} = \sqrt{3} \bullet E_L \bullet I_L$ (omit $\sqrt{3}$ for 1Φ)	**(W)** $P_{3\Phi} = \sqrt{3} \bullet E_L \bullet I_L \bullet \cos\theta$ *(omit $\sqrt{3}$ for 1Φ)*	**(VAR)** $Q_{3\Phi} = \sqrt{3} \bullet E_L \bullet I_L \bullet \sin\theta$ *(omit $\sqrt{3}$ for 1Φ)*
$pf = cos(tan^{-1}(1.732\left(\frac{W2 - W1}{W2 + W1}\right)))$		

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Electronics		
1Φ half wave	1Φ full wave	
$E_{AVG} = E_{RMS} * \sqrt{2} * 0.318$	$E_{AVG} = E_{RMS} * \sqrt{2} * 0.637$	$E_{AVG} = E_P \frac{(1+\cos\alpha)}{\pi}$ *(full wave)*
$E_{AVG} = E_{RMS} \div 2.22$ (form factor)	$E_{AVG} = E_{RMS} \div 1.11$ (form factor)	$E_{AVG} = E_P \frac{(1+\cos\alpha)}{2\pi}$ *(half wave)*
3Φ half wave	3Φ full wave	
$E_{AVG} = E_{RMS} * \sqrt{2} * 0.827$	$E_{AVG} = E_{RMS} * \sqrt{2} * 0.955$	
$E_{AVG} = E_{RMS} * 1.17$ (form factor)	$E_{AVG} = E_{RMS} * 1.35$ (form factor)	

Machines		
$\frac{E_P}{E_S} = \frac{N_P}{N_S} = \frac{I_S}{I_P}$	$I_{SC} = \frac{I_{Secondary}}{\%_{IZ}}$	
$HP = \frac{2\pi NT}{60 \bullet 550}$ and $HP = \frac{NT}{5252}$ *(Imperial)*	$P = \frac{2\pi NT}{60}$ *(SI)*	$T \propto E^2$ *(in an induction machine)*
$N \propto k\Phi E$	$T \propto k\Phi I$ *(for a dc machine, for an AC machine, power factor of the rotor current must be taken into account)*	
$N_{SLIP} = N_{SYNCH} - N_{ROTOR}$	$\%slip = \frac{Ns - Nr}{Ns} X100$	$N_{SYNCH} = \frac{N_{ROTOR}}{1 - \%Slip(decimal)}$
$\%V_{reg} = \frac{V_{NL} - V_{FL}}{V_{FL}} \times 100$	$\%N_{reg} = \frac{N_{NL} - N_{FL}}{N_{FL}} \times 100$	$f_{ROTOR} = \frac{N_{SLIP} \bullet P}{2 * 60}$
$f = \frac{N \bullet P}{2*60}$ *(P is poles)* Or $f = \frac{N \bullet P}{60}$ *(P is pairs of poles)*	$N = \frac{2*60f}{P}$ *P is poles* Or $N = \frac{60f}{P}$ *P is pairs of poles*	