ECE215/S – Principles of Electronic Cyber Warfare
Equation Sheet - Midterm
Objectives 1.1-1.8, 2.1-2.4

DC Circuits Analysis

Ohm's Law	$V = IR$
Power Law	$P = IV = \frac{V^2}{R} = I^2R$
Series	$R_{eq} = R_1 + R_2 + \ldots + R_n$
Voltage Divider	$V_x = \frac{R_x}{R_{eq}} V_{series}$
Parallel	$R_{eq} = (\frac{1}{R_1} + \frac{1}{R_2} + \ldots + \frac{1}{R_n})^{-1}$
→ 2 resistors	$R_{eq} = \frac{R_x R_y}{R_x + R_y}$
Current Divider	$I_x = \frac{R_{eq}}{R_x} I_{parallel}$
→ 2 resistors	$I_x = \frac{R_y}{R_x + R_y} I_{parallel}$

AC Circuits Analysis

AC equation	$v(t) = V_{bias} + V_m \cos 360° ft + \phi$
Frequency	$f = \frac{1}{\text{period}} = \frac{1}{T}$
Bias	$V_{bias} = \frac{v_{\max} + v_{\min}}{2}$
Amplitude	$V_m = \frac{v_{\max} - v_{\min}}{2}$
RMS	$V_{rms} = \frac{V_m}{\sqrt{2}} = 0.707 * V_m$
S	$I_{rms} V_{rms}$
P	$pf * S$
Q	$\sqrt{S^2 - P^2}$
$Q > 0$	lagging (I lags V)
$Q < 0$	leading (I leads V)

Motors, Power Converters

Efficiency	$\eta = \frac{P_{out}}{P_{in}} = \frac{P_{useful}}{P_{useful} + P_{loss}}$
Mechanical Power	1 hp = 745.7 Watts

Transformers

Turns ratio	$a = \frac{N_1}{N_2} = \frac{v_1(t)}{v_2(t)} = \frac{i_2(t)}{i_1(t)}$

Complex Math

Imag Number	$j = \sqrt{-1}$
	$\frac{1}{j} = -j$
Rectangular	$Re + jIm$
	$= A\cos\phi + jA\sin\phi$
Phasor	$A\angle\phi$
Amplitude	$A = \sqrt{Re^2 + Im^2}$
Phase	$\phi = \tan^{-1}\left(\frac{Im}{Re}\right)$

R-C and R-L Circuits

Angular Frequency	$\omega = 2\pi f$
Resistor Impedance	Z_R =R
Capacitor Impedance	$\mathrm{Z}_C = \frac{1}{j\omega C}$
Inductor Impedance	$\mathrm{Z}_L = j\omega L$
R-C Circuit Cutoff	$f_{\text{cutoff}} = \frac{1}{2\pi RC}$
R-L Circuit Cutoff	$f_{\text{cutoff}} = \frac{R}{2\pi L}$
Bandwidth	$BW = f_{high} - f_{low}$
Gain	$\mathrm{G}_{abs} = \left\lvert\frac{\mathrm{V}_{\text{out}}}{\mathrm{V}_{\text{in}}}\right\rvert$

Engineering Notation

10^{12}	T (tera)
10^{9}	G (giga)
10^{6}	M (mega)
10^{3}	k (kilo)
10^{-3}	m (milli)
10^{-6}	μ (micro)
10^{-9}	n (nano)
10^{-12}	p (pico)
10^{-15}	f (femto)
10^{-18}	a (atto)