UNIT 4
STUDY GUIDE*

To pass the unit exam, you must be able to do the following (using books and notes):

CONCEPTUAL TOOLS	Learning Objective	Reading
COMPLEX ANALYSIS EXPLANATIONS OF j CONVENIENT EXAMPLES BASIC MATH Addition and subtraction EXAMPLE | (PDF) Multiplication Rationalization EXAMPLE 1 | (PDF) EXAMPLE 2 | (PDF) Conjugate DEFINITION | (PDF) EXAMPLE 1 | (PDF) EXAMPLE 2 | (PDF) EXAMPLE 3 | (PDF) Magnitude EXAMPLE 1 | (PDF) Phase Re[] EXAMPLE 1 | (PDF) EXAMPLE 2 | (PDF) Im[] Roots and Powers N*TH* ROOTS example | (pdf) N*TH* ROOTS OF UNITY POWERS example | (pdf) RECT AND POLAR FORMS Euler's formula (complex exp) Polar form Rect<->polar xform triangle EXAMPLE 1 | (PDF) EXAMPLE 2 | (PDF) Example | (pdf)	4.1 Perform these operations on complex numbers: a. Multiply, divide, add, and subtract complex numbers. b. Find the complex conjugate of any complex number. c. Rationalize the denominator of a fraction of complex numbers. d. Convert from polar form to rectangular form and vice versa. e. Find the real part of any complex number. f. Find the absolute value (i.e., magnitude) of any complex number. g. Find the nth root or power of any complex number.	App B
COMPLEX ANALYSIS PHASORS Tutorial | (pdf) Rotating stick shadow Identities Phasor math Phasor<->inv-phasor xform EXAMPLE 1 | (PDF) EXAMPLE 1 (CONT) (PDF) EXAMPLE 2 | (PDF) EXAMPLE 2 (CONT) (PDF)	4.2 Take the phasor transform of a sinusoidal function of time and inverse phasor transform of a phasor.	Chap 9 Sec 9.1-9.3

* The material in this handout is based extensively on concepts developed by C. H. Durney, Professor Emeritus of the University of Utah.

IMPEDANCE CIRCUITS OHM'S LAW Statement Series impedances Parallel impedances Impedance networks Example 1 (pdf) Example 2 (pdf)	4.3	Transform circuits to the frequency domain and apply the concept of impedance in the frequency domain. This includes finding the equivalent impedance of combinations of elements.	Chap 9: Sec 9.4,9.6
IMPEDANCE CIRCUITS KIRCHHOFF'S LAWS Example (pdf)	4.4	Apply Kirchhoff's laws in the frequency domain.	Chap 9: Sec 9.5
IMPEDANCE CIRCUITS NODE-VOLTAGE METHOD Example (pdf)	4.5	Apply the node-voltage method in the frequency domain.	Chap 9: Sec 9.8
IMPEDANCE CIRCUITS MESH-CURRENT METHOD Example (pdf)	4.6	Apply the mesh-current method in the frequency domain.	Chap 9: Sec 9.9
IMPEDANCE CIRCUITS THEVENIN EQUIVALENT Deriving Thevenin equivalent Example 1 (pdf) Example 2 (pdf)	4.7	In the frequency domain, transform sources and find Thevenin and Norton equivalent circuits.	Chap 9: Sec 9.7
SUPERPOSITION CIRCUITS $V_{AC} + V_{AC}$ EXAMPLE (PDF)	4.8	Apply the principle of superposition in the frequency domain.	
COMPLEX ANALYSIS PHASORS Phasor diagrams EXAMPLE (PDF)	4.9	Draw appropriate phasor diagrams and use them in analyzing and designing circuits.	Chap 9: Sec 9.12
	4.10.	Make consistency checks in *s* domain.	-
FILTERS RC AND RL FILTERS Example 1 (pdf) Example 2 (pdf) Example 3 | (pdf)	4.11	Calculate transfer functions, cutoff frequencies, and outputs for passive low-pass and high-pass RC and RL filters. Qualitatively sketch frequency responses of these filters.	Chap 13 Sec 13.4-13.7 Chap 14 Sec 14.1-14.3
FILTERS RLC FILTERS Frequency response EXAMPLE 1 (PDF) EXAMPLE 2 (PDF) EXAMPLE 3 | (PDF) LC resonance | (pdf) EXAMPLE | (PDF) Qualitative response | (pdf) EXAMPLE 1 | (PDF) EXAMPLE 2 (PDF) EXAMPLE 3 | (PDF) EXAMPLE 4 | (PDF) **EXAMPLE 5 | (PDF)**	4.12	For RLC passive bandpass and bandreject filters, calculate the transfer function, the resonant frequency, the cutoff frequencies, the bandwidth, and the quality factor. Qualitatively sketch frequency responses of these filters and explain how R, L, and C affect the frequency response.	Chap 14 Sec 14.4-14.5