Exam 1 Review Topics

Exam 1 Monday February 28, 2011
Closed book, closed notes, no calculators Coverage: Chapters 1-4

Topics:

Chapter 1  Modulation and Receiver block diagram.

Chapter 2  
High frequency equivalent circuits of capacitors and inductors (note error in Fig. 2.9)
Find resistance of arbitrary shape using curvilinear squares
High frequency resistance of a wire due to skin effect.

Chapter 3  
Definition of series and parallel Q and how they differ.
For a simple LC resonant circuit, \[ \Delta \omega = 1/RC, \quad \omega_0 = \sqrt{\omega_1 \omega_2} \]
For a resonant series circuit,
\[ Q = \frac{\omega_0}{2R(\omega_0)} \left. \frac{dX}{d\omega} \right|_{\omega_0} \]
The analogous term for a parallel circuit.
L and \( \pi \) impedance matching circuits with ladder network (Be familiar with table).
Impedance transformation of an el circuit: \( R' = R \cdot (1 + Q^2) \pm 1 \)
Tapped capacitor matching circuit
Understand process in Parallel Double-tuned transformer design. Tables provided if needed.

Chapter 4  
How to convert between two port parameters
How to add circuits connected in series etc.
Image impedance of a two port: \( Z_I = \sqrt{Z_{oc}Z_{sc}} \)
Image propagation constant: \( e^\gamma = \sqrt{v_1i_1/v_2(-i_2)} \)
Input impedance of a two port:
\[ Z_{in} = Z_{I1}Z_L + Z_{I2} \tanh \gamma \]
\[ Z_{in} = Z_{I1}Z_L Z_{I2} + Z_L \tanh \gamma \]

Telegrapher’s Equations:
\[ \frac{\partial V}{\partial z} = -L \frac{\partial I}{\partial t} \]
\[ \frac{\partial I}{\partial z} = -C \frac{\partial V}{\partial t} \]
\[ v = \frac{1}{\sqrt{LC}} \]
\[ Z_0 = \sqrt{\frac{L}{C}} = \frac{1}{Cv} \]
Relationship of Telegrapher’s equations to Maxwell’s equations

Know transmission line equation

\[ Z_{in} = Z_0 \frac{Z_L + Z_0 \tanh \gamma \ell}{Z_0 + Z_L \tanh \gamma \ell} \]

Scattering parameters

\[ a = \frac{1}{2\sqrt{Z_0}} (V + Z_0 I) \]
\[ b = \frac{1}{2\sqrt{Z_0}} (V - Z_0 I) \]
\[ [b] = [S][a] \]

Convert from [S] parameters to other 2-port parameters such as [Z].