Review Exam # 2  
EE 5347


Impedance Transformer Design  Be able to do recursion analysis for $\lambda/4$ transformer.  
Table 3.1 will be provided on the exam if needed.  

Filter Approximation  

$$G = \frac{1}{1 + (f/f_c)^{2n}}$$  

$$G = \frac{1}{1 + \epsilon^2 T_n(f/f_c)}$$

Lowpass prototype and conversion to other filter types.  

Richard’s Transformation  

$$S = \Sigma + j\Omega \quad \text{where} \quad S = \tanh(\beta L)$$

Know how to use and derive the 4 Kuroda Identities  
Filter design using redundant ue’s.  
1 Lowpass prototype  
2 Insert ue’s at ends  
3 Use Richard’s transformation to replace L,C with stubs.  

Richard’s Theorem  
If $Z(1) = -Z(-1)$, then the impedance contains a ue.  
The remaining impedance is the inversion of the transmission line equation.  

$$Z_L(S) = Z(1) \frac{Z(S) - SZ(1)}{Z(1) - SZ(S)}$$

Nonredundant filter synthesis  
If the desired filter function is $|\Gamma|^2/|T|^2$ then  

$$|\Gamma|^2 = \frac{|\Gamma|^2}{|T|^2(1 + |\Gamma|^2/|T|^2)}$$

Find $\Gamma(S)$ from $|\Gamma(S)|^2$.
**Coupled Lines** Know the equivalent circuit for a coupled line (Fig. 3.20). Know how to derive circuits in Fig. 3.22.

\[ n^2 = 1 + Z_2/Z_1 = \left[ \frac{Z_{0e} + Z_{0o}}{Z_{0e} - Z_{0o}} \right]^2 \]

\[ Z_{0e} = Z_1(1 + 1/n) = \frac{1}{vC_e} \]

\[ Z_{0o} = Z_1(1 - 1/n) = \frac{1}{vC_o} \]

Know Definition of impedance inverter and their realizations.

**Coupled Line Filter**

\[ Z_{0ei} = \frac{1}{C\omega} \left[ \tan \frac{\theta_1}{2} + \frac{\sin \theta_1}{\sqrt{g_ig_{i+1}}} \right] \]

\[ Z_{0ei} = \frac{1}{C\omega} \left[ \tan \frac{\theta_1}{2} - \frac{\sin \theta_1}{\sqrt{g_ig_{i+1}}} \right] \]

\[ Z_{e0} = R_A \left[ 1 + \sqrt{\frac{h}{\omega g_0g_1}} \right] \]

\[ Z_{o0} = R_A \left[ 1 - \sqrt{\frac{h}{\omega g_0g_1}} \right] \]

\[ h = \left[ \frac{1}{g_0g_1} + \frac{\tan \theta_1}{2} \right]^{-1} \]

\[ \theta_1 = \frac{\pi}{2}(1 - \frac{w}{2}) \]

Know the equivalent circuit of open circuit coupled line (Fig. 3.40).