Lecture 9 26th March

# Smith Chart

Uses:

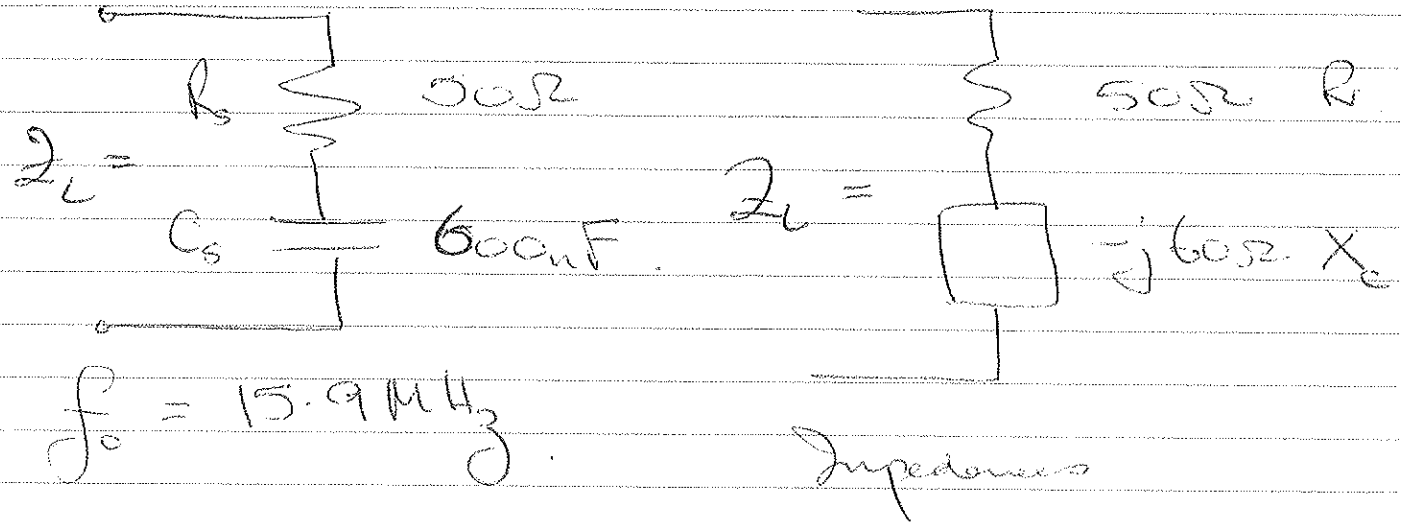
(1) Easy conversion between Z and Γ

(2) Easy conversion between Z, Γ

(3) Impedance matching with lumped components ("low" frequencies < 500MHz)

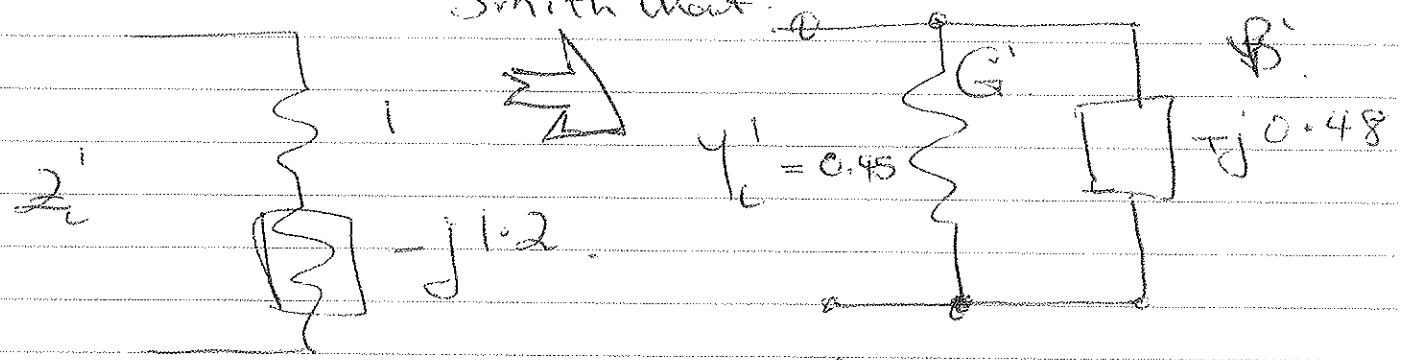
(4) Impedance matching with transmission lines ("high" frequencies > 500MHz)

$$Z = R + jX = R - \frac{j}{\omega C}$$




Impedance

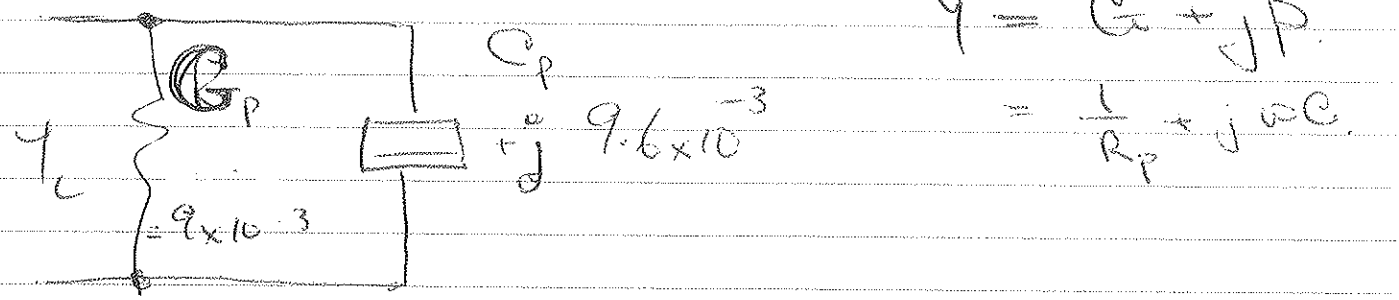
Smith Chart.




Admittance

$$Y = G + jB$$

$$= \frac{1}{R_p} + j\omega C.$$




$$\therefore 10^7 \times C = 9.6 \times 10^{-3}.$$

$$\therefore C_p = 96\ pF.$$

$$R_p = 110\Omega.$$

Q.1

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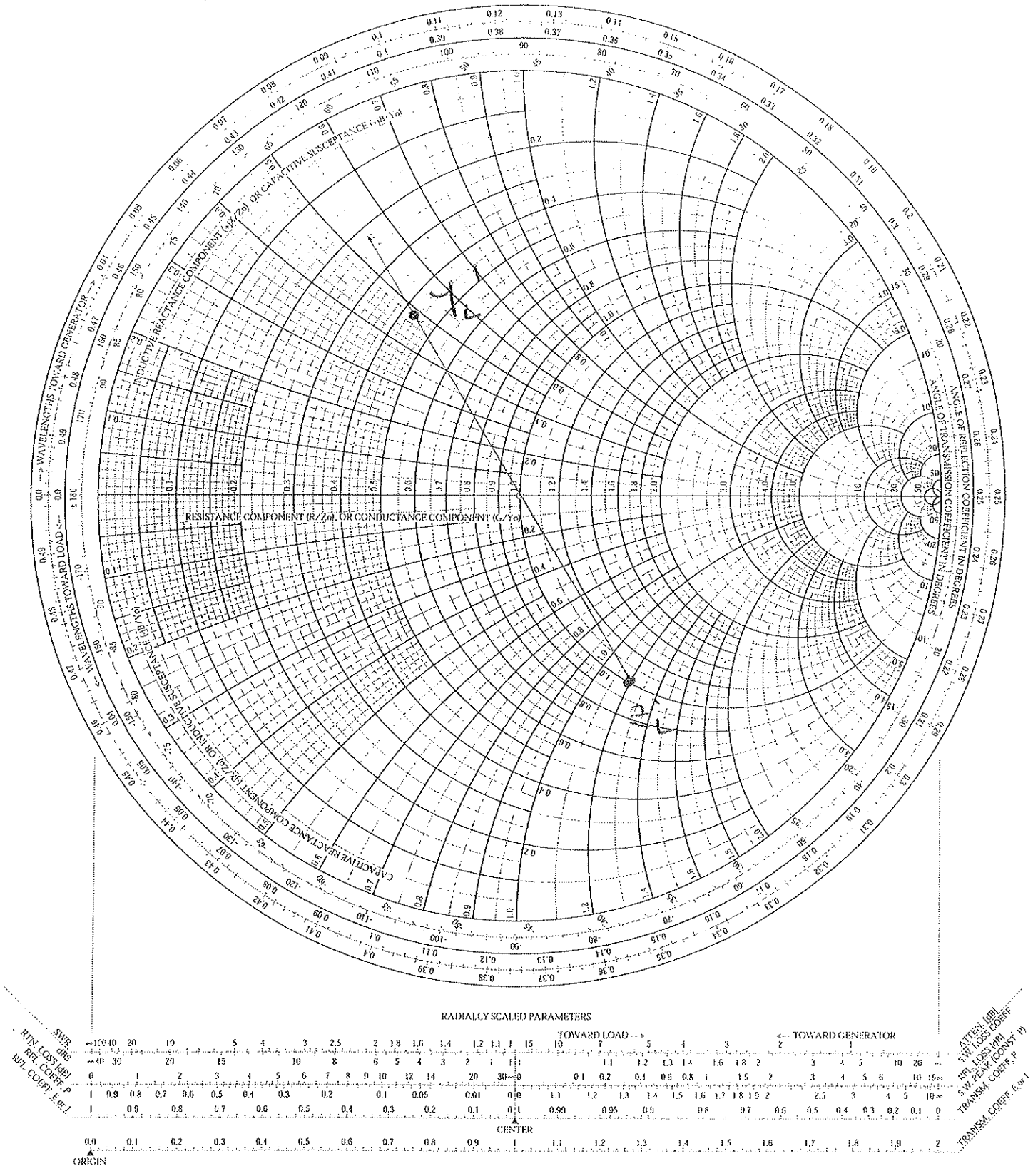
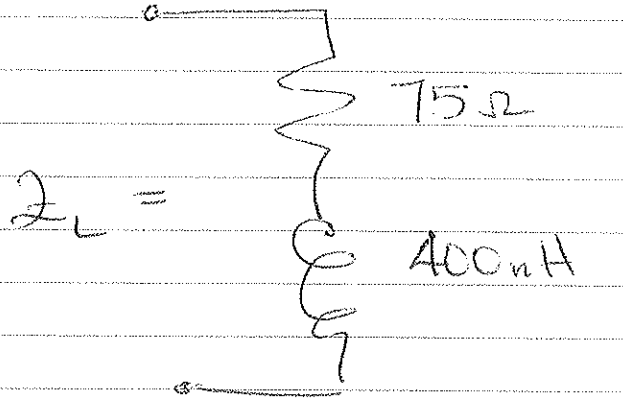
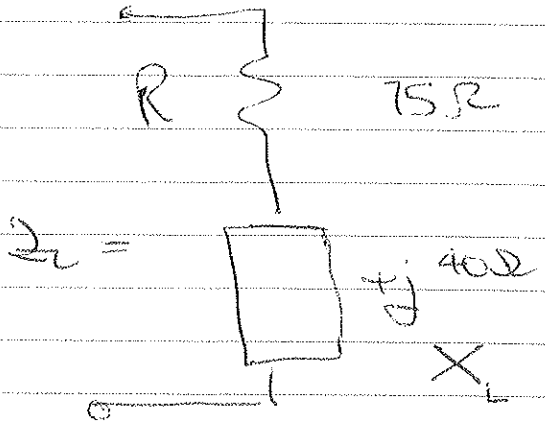
# Smith Chart

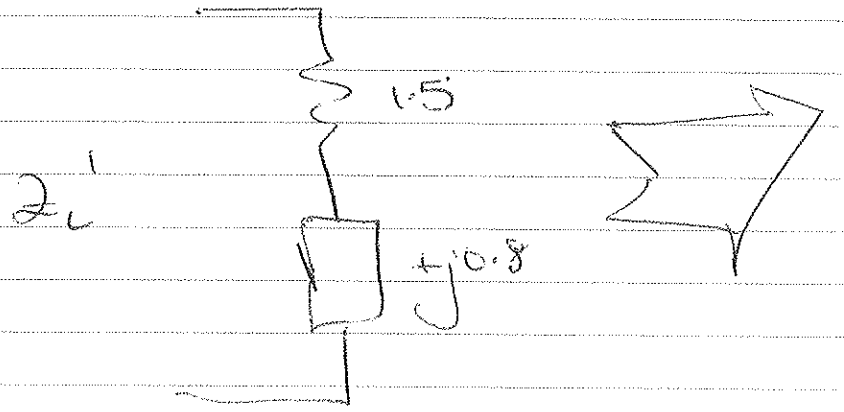


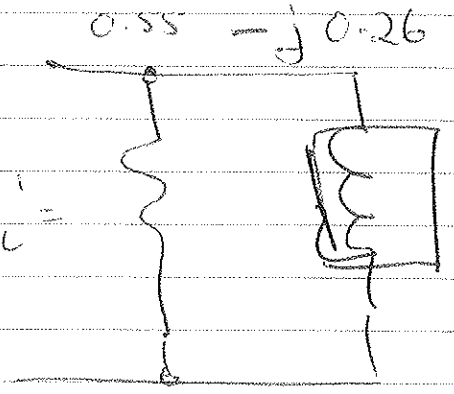

To be handed in with your answer booklet

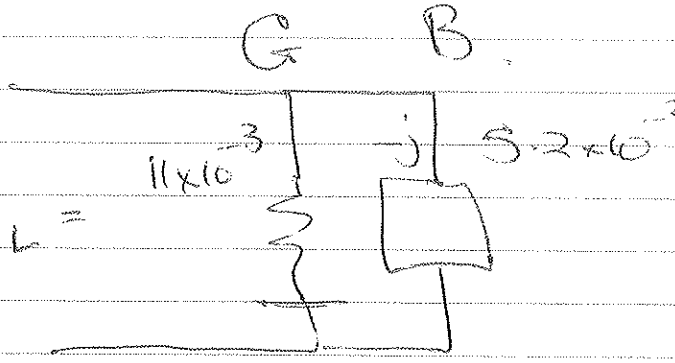


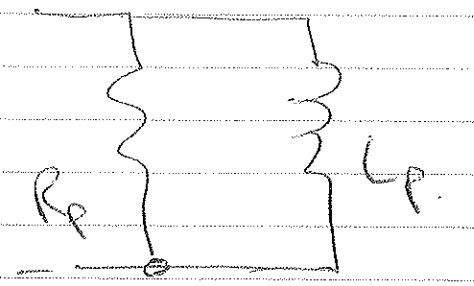




$f_0 = 15.9 \times 10^6$ Hz  $\omega_0 = 10^8$




$R_p = 90\,\Omega$.

$L_p = 1.9\ \mu H$.

$5.2 \times 10^{-3} = \frac{1}{10^8 L}$

$L = \frac{1}{\quad}$

3.1

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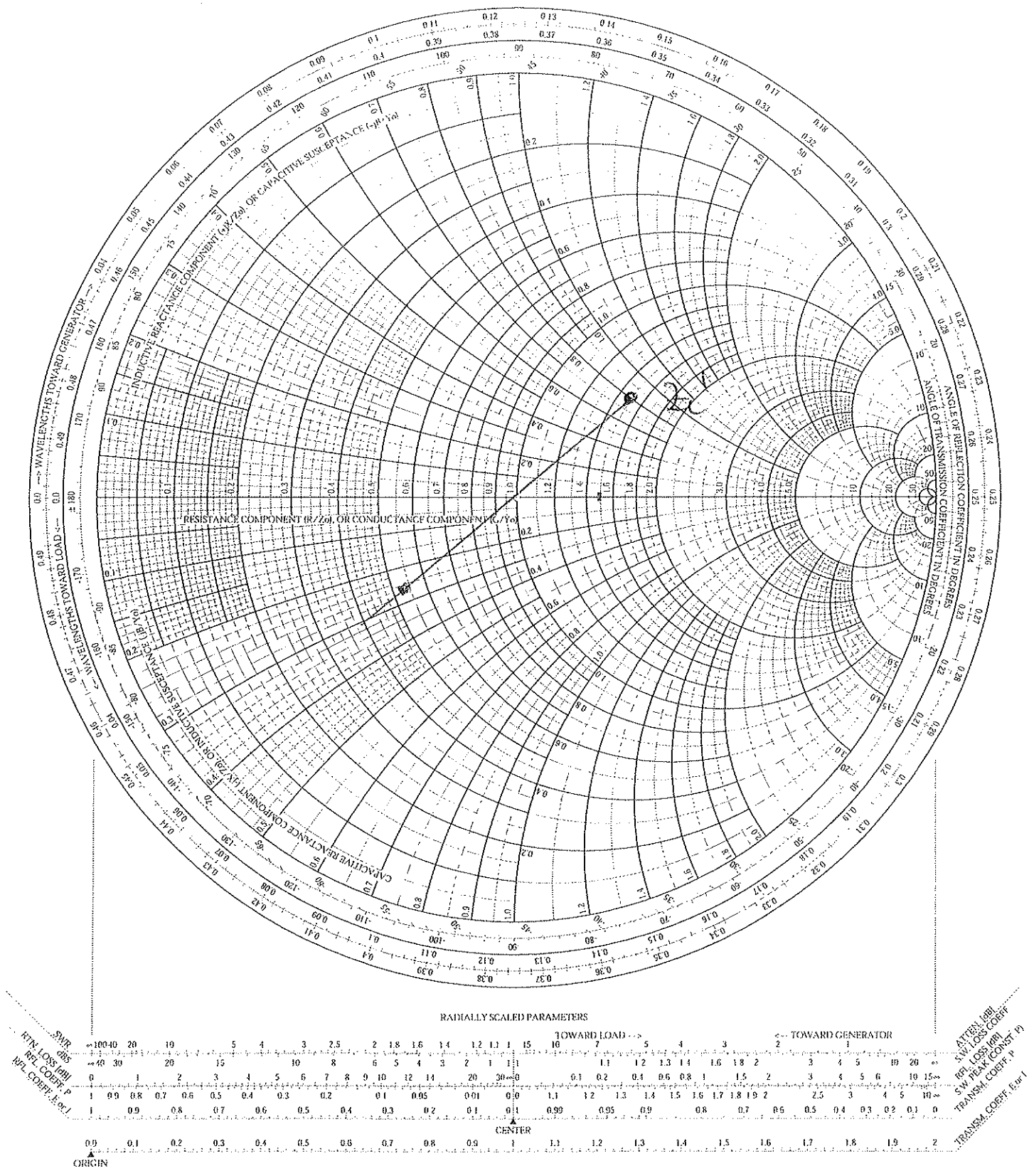
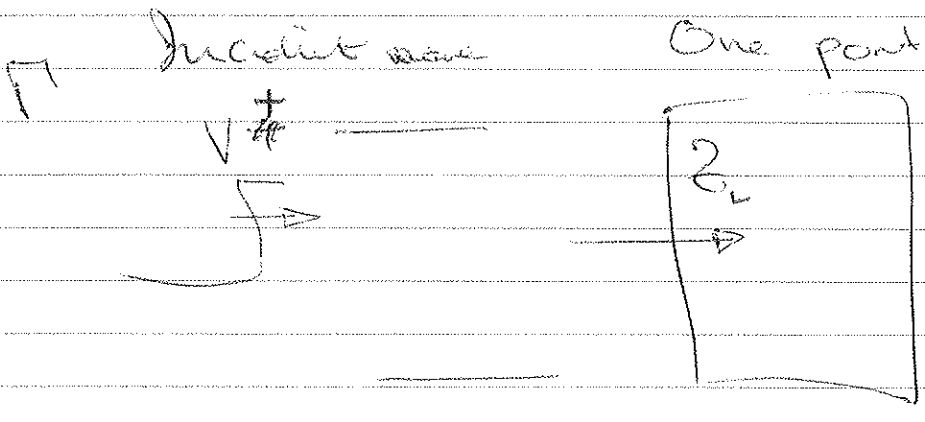
# Smith Chart




To be handed in with your answer booklet

## ② Reflection Coeffs.




$$\Gamma \equiv \frac{V^-}{V^+} = \frac{Z_L - Z_0}{Z_L + Z_0}$$

= Reflected wave amplitude / Incident wave amplitude

① Let $Z_L = 50\Omega$ and $Z_0 = 50\Omega$.

$\Gamma_{SC} = 0$

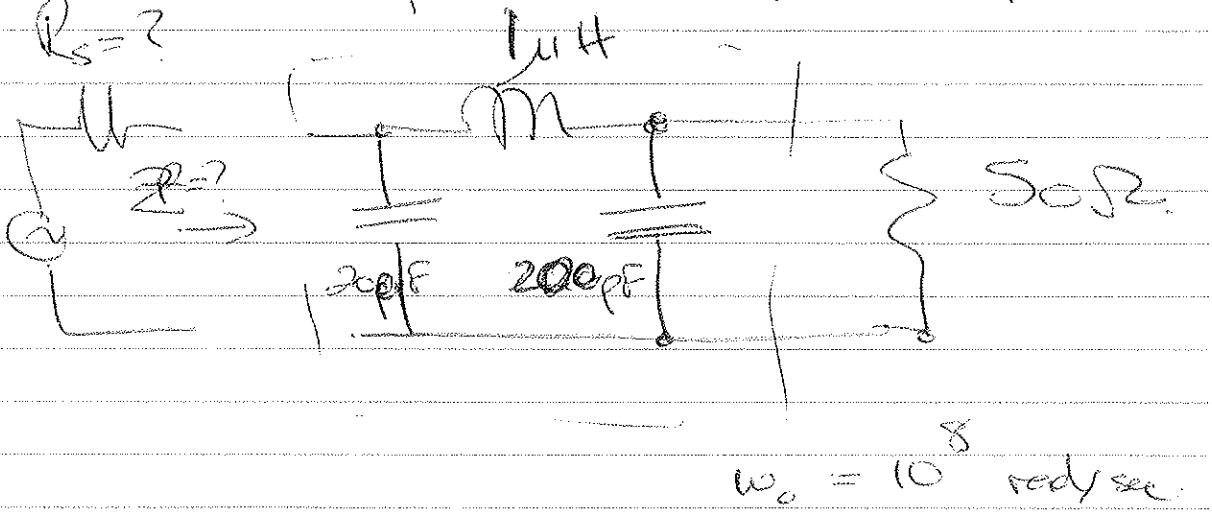
② Let $Z_L = OC$ i.e. $\infty$.

$$\Gamma_{OC} = \frac{1 - Z_0/Z_L}{1 + Z_0/Z_L} = 1 \angle 0^\circ$$

③ Let $Z_L = SC$ i.e. $0$.

$$\Gamma = \frac{Z_L/Z_0 - 1}{Z_L/Z_0 + 1} = -1 = 1 \angle 180^\circ$$

③ Impedance Matching with Lumped Component




$\omega_0 = 10^8$ rad/sec

Step 1. Convert to impedance (Res and Reac)