4) optimum admittance

$$R_n = \frac{\overline{V_{neq}^2}}{4KT\Delta f} = \frac{\left(\frac{1}{g_{m1}}\right)^2 4KT\gamma g_{m1}\Delta f + 4KTR_{g1}\Delta f}{4KT\Delta f}$$

$$= \frac{\gamma}{g_{m1}} + R_g$$

$$G_u = \frac{\overline{i_{nu}^2}}{4KT\Delta f} = \frac{4KT\gamma g_{m2}\Delta f + g_{m2}^2 \cdot 4KTR_{g2}\Delta f}{4KT\Delta f}$$

$$= \gamma g_{m2} + g_{m2}^2 R_{g2}$$

$$= g_{m2}(\gamma + g_{m2}R_{g2})$$

$$\therefore G_{s,opt} = \sqrt{\frac{G_u}{R_n}} = \sqrt{\frac{g_{m2}(\gamma + g_{m2}R_{g2})}{\frac{\gamma}{g_{m1}} + R_{g1}}}$$

$$= \sqrt{\frac{g_{m1} \cdot g_{m2}\left(1 + \frac{1}{\gamma} g_{m2} \cdot R_{g2}\right)}{1 + \frac{1}{\gamma} g_{m1} R_{g1}}}$$

$$B_{s,opt} = 0$$

$$\Rightarrow Y_{s,opt} = G_{s,opt}$$

5) $$F_{min} = 1 + 2R_n\sqrt{\frac{G_u}{R_n}}$$

$$= 1 + 2\frac{\gamma}{g_{m1}}\sqrt{\frac{g_{m1}g_{m2}\left(1 + \frac{1}{\gamma} g_{m2} \cdot R_{g2}\right)}{1 + \frac{1}{\gamma} g_{m1} R_{g1}}}$$

if, $g_{m1} = g_{m2}$ and $R_{g2} \approx R_{g1}$, then $F_{min} \approx 1 + 2\gamma \cdot g_m$