



1) Under mismatched conditions,

$$Z_s = R_s + jX_s$$

$$Z_L = (R_s + \Delta R_s) - j(X_s + \Delta X_s)$$

$$\Rightarrow V_L = \frac{Z_L}{Z_s + Z_L} V_s$$

$$= \frac{R_s + \Delta R_s - j(X_s + \Delta X_s)}{2R_s + \Delta R_s - j\Delta X_s} V_s$$

$$\Rightarrow \tilde{i}_L = \frac{1}{2R_s + \Delta R_s - j\Delta X_s} V_s$$

- Voltage across  $R_L \Rightarrow V_{RL} = \frac{R_s + \Delta R_s}{2R_s + \Delta R_s - j\Delta X_s} V_s$

- Current through  $R_L \Rightarrow \tilde{i}_{RL} = \frac{1}{2R_s + \Delta R_s - j\Delta X_s} V_s$

$$\therefore P_{RL} = \operatorname{Re}(V_{RL} \cdot \tilde{i}_{RL}^*)$$

$$= \frac{(R_s + \Delta R_s) V_s^2}{(2R_s + \Delta R_s)^2 + (\Delta X_s)^2}$$

$$= \boxed{\frac{V_s^2}{4R_s} \frac{\left(1 + \frac{\Delta R_s}{R_s}\right)}{\left(1 + \frac{\Delta R_s}{2R_s}\right)^2 + \left(\frac{\Delta X_s}{2R_s}\right)^2}} \quad (\text{Ans})$$

(if  $V_s$  is peak value, then

$$P_{RL} = \boxed{\frac{1}{2} \cdot \frac{V_s^2}{4R_s} \frac{\left(1 + \frac{\Delta R_s}{R_s}\right)}{\left(1 + \frac{\Delta R_s}{2R_s}\right)^2 + \left(\frac{\Delta X_s}{2R_s}\right)^2}} \quad (\text{Ans})$$