

$$2) \hat{I}_{R_{ind}} = \frac{V_s}{2R_s} \cdot \frac{R_L}{sL + R_{ind} + R_L}$$

$$V_{R_{ind}} = \hat{I}_{R_{ind}} \cdot R_{ind}$$

$$\therefore P_{ind} = R_L (V_{R_{ind}} \cdot \hat{I}_{R_{ind}}^*)$$

$$= \frac{V_s^2}{4R_s^2} \cdot R_{ind} \cdot \frac{R_L}{(R_{ind} + R_L)^2 + \omega_0^2 L^2}$$

$$= \frac{V_s^2}{4R_s} \cdot \frac{R_L}{R_s} \cdot \frac{R_{ind}/R_L}{\left(1 + \frac{R_{ind}}{R_L}\right)^2 + \left(\frac{\omega_0 L}{R_L}\right)^2}$$

$$= \frac{V_s^2}{4R_s} (Q_T^2 + 1) \cdot \frac{\frac{1}{Q_T \cdot Q_{ind}}}{\left(1 + \frac{1}{Q_T \cdot Q_{ind}}\right)^2 + \left(\frac{1}{Q_T}\right)^2}$$

$$= \frac{V_s^2}{4R_s} (Q_T^2 + 1) \cdot \frac{Q_T \cdot Q_{ind}}{(1 + Q_T \cdot Q_{ind})^2 + Q_{ind}^2}$$

$$3) \eta = \frac{P_L}{P_L + P_{ind}} = \frac{\left(R_{ind}/R_L\right)^2 + \left(\omega_0 L/R_L\right)^2}{\left(R_{ind}/R_L\right)^2 + \left(\omega_0 L/R_L\right)^2 + R_{ind}/R_L}$$

$$= \frac{1 + Q_{ind}^2}{1 + Q_{ind}^2 + Q_T \cdot Q_{ind}}$$

if $Q_{ind} \gg 1$

$$\approx \frac{Q_{ind}}{Q_{ind} + Q_T} \leftarrow \text{same as problem-2.}$$

$$4) \eta = \frac{Q_{ind}}{Q_{ind} + Q_T}$$