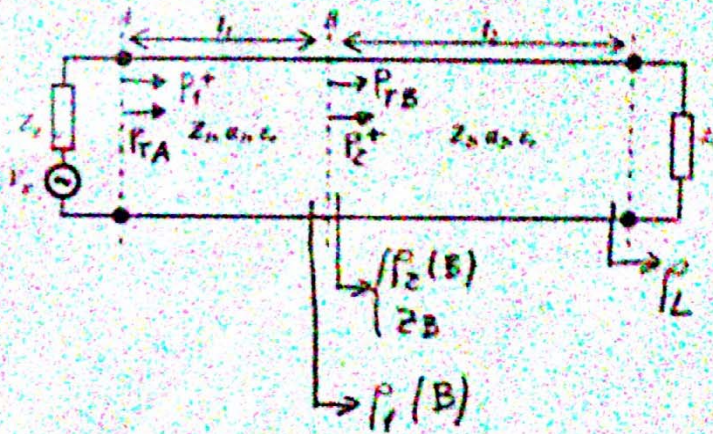


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$$P_{dg} = \frac{|V_g|^2}{8Z_g} = 987 \text{ mW}$$

$$\lambda = c_0 / f = 300 \text{ cm}$$

$$l_2 = 150 \text{ cm} = \lambda/2$$

$$\Gamma_L = \frac{75 - 25}{75 + 25} = 0,5 \quad ; \quad \rho_2(B) = \rho_L e^{-2\alpha_2 l_2} = \rho_L e^{-2 \times 0,2 \times 150} e^{j2\pi} = 0,5 \cdot 0,986 = 0,493$$

$$Z_B = 25 \frac{1 + 0,493}{1 - 0,493} = 62,72 \Omega \quad ; \quad \rho_1(B) = \frac{62,72 - 50}{62,72 + 50} = 0,113$$

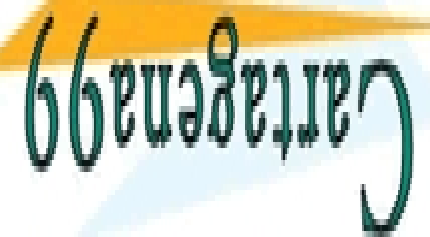
$$P_{TB} = P_1^+ (1 - |\rho_1(B)|^2) = P_{dg} (1 - |\rho_1(B)|^2) = 987 \text{ mW}, \text{ ya que } P_1^+ = P_{dg} \text{ y } \alpha_1 = 0 \text{ y } \rho_1 = \rho_1$$

$$P_{TB} = P_2^+ (1 - |\rho_2(B)|^2) \rightarrow P_2^+ = P_{TB} / (1 - |\rho_2(B)|^2) = 1214 \text{ mW}$$

$$P_L = P_2^+ e^{-2\alpha_2 l_2} (1 - |\rho_L|^2) = 1214 \cdot 0,986 \cdot 0,75 = 781 \text{ mW}$$

$$P_{\text{Perdidas en } l_2} = P_{TA} - P_L = P_{TB} - P_L = 987 - 781 = 206 \text{ mW}$$

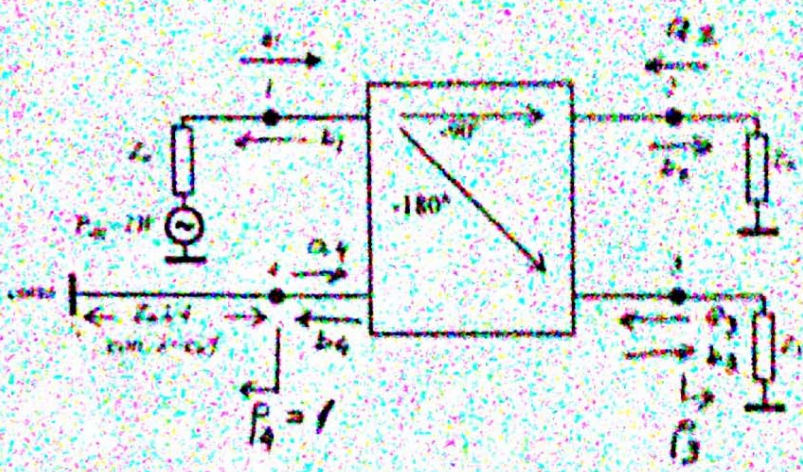
$$\text{ya que } P_{TB} = P_{TA}$$



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c) En estas condiciones, calcular la potencia entregada en el acceso 2 y la reflejada en el 1



$|a_1|^2 = |b_1|^2 \rightarrow a_1 = 1 \angle 0^\circ$
 $a_2 = 0$
 $a_3 = \Gamma b_3$
 $a_4 = \Gamma b_4 = b_4$

a)
$$S = \begin{pmatrix} 0 & -j/\sqrt{2} & -4/\sqrt{2} & 0 \\ -j/\sqrt{2} & 0 & 0 & -1/\sqrt{2} \\ -1/\sqrt{2} & 0 & 0 & -j/\sqrt{2} \\ 0 & -1/\sqrt{2} & -j/\sqrt{2} & 0 \end{pmatrix}$$

b)
$$B = S \cdot A \Rightarrow \begin{pmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ \Gamma b_3 \\ b_4 \end{pmatrix} \rightarrow \begin{cases} b_1 = -\Gamma b_3 / \sqrt{2} & 1) \\ b_2 = -j/\sqrt{2} - b_4 / \sqrt{2} & 2) \\ b_3 = -1/\sqrt{2} - j\Gamma b_3 / \sqrt{2} & 3) \\ b_4 = -j\Gamma b_3 / \sqrt{2} & 4) \end{cases}$$

de 3) y 4)
$$b_3 = -1/\sqrt{2} + j/\sqrt{2} \frac{\Gamma b_3}{\sqrt{2}} = \frac{-1}{\sqrt{2}} - \frac{\Gamma b_3}{2} \rightarrow b_3 = \frac{-1/\sqrt{2}}{1 + \Gamma/2} = \frac{-2}{3} \rightarrow \Gamma = \frac{2}{3} \sqrt{2} - 2 = 0,121 \rightarrow Z_3 = Z_0 \frac{1 + \Gamma}{1 - \Gamma} = 63,76 \Omega$$



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Handwritten notes on a grid background:

$1.2 = \frac{2}{3} \rightarrow P_2 = (1.2)^2 = 1.44$

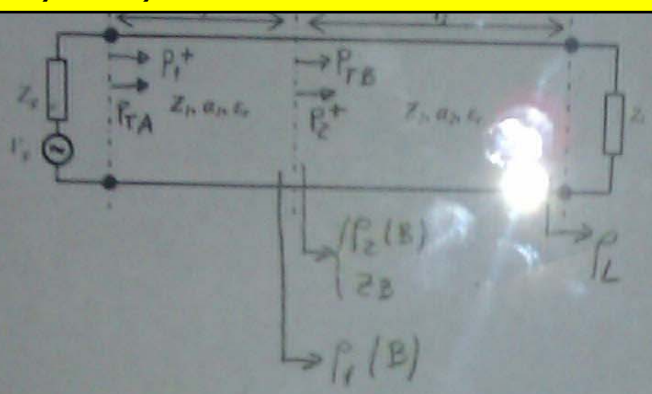
$1.2 \times 1.2 = 1.44$

Ejercicio 1 (50 puntos)

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$$\lambda = c_0 / f = 300 \text{ cm}$$

$$l_2 = 150 \text{ cm} = \lambda / 2$$

$$P_L = \frac{75 - 25}{75 + 25} = 0,5 \quad ; \quad P_2(B) = P_L e^{-2\alpha_2 l_2} = P_L e^{-2 \times 0,01 \times 150} = 0,5 \cdot 0,86 = 0,43$$

$$Z_B = 25 \frac{1 + 0,43}{1 - 0,43} = 62,72 \Omega \quad ; \quad P_1(B) = \frac{62,72 - 50}{62,72 + 50} = 0,113$$

$$P_{TB} = P_1^+ (1 - |P_1(B)|^2) = P_{dg} (1 - |P_1(B)|^2) = 987 \text{ mW}$$

ya que $P_1^+ = P_{dg}$ y $\alpha_1 = 0$ $Z_1 = Z_0$

$$P_{TB} = P_2^+ (1 - |P_2(B)|^2) \rightarrow P_2^+ = P_{TB} / (1 - |P_2(B)|^2) = 1211 \text{ mW}$$

$$P_L = P_2^+ e^{-2\alpha_2 l_2} (1 - |P_L|^2) = 1211 \cdot 0,86 \cdot 0,75 = 781 \text{ mW}$$

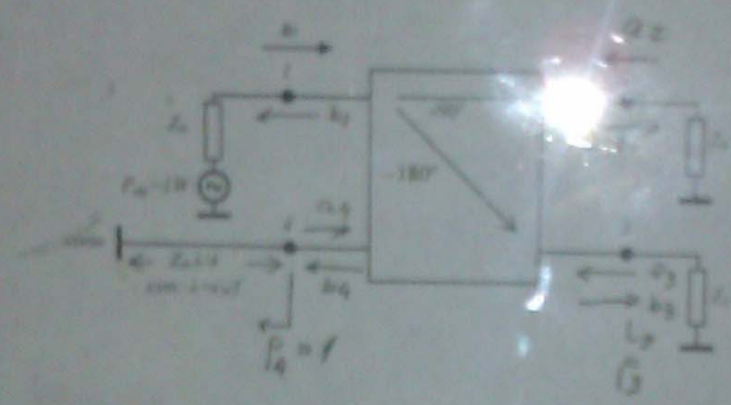
$$P_{\text{perdidas en } l_2} = P_{TA} - P_L = P_{TB} - P_L = 987 - 781 = 206 \text{ mW}$$

ya que $P_{TB} = P_{TA}$



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b) Suponiendo que el acoplador se carga como se muestra en la figura, calcular la impedancia Z_L para que la señal incidente en ella sea $(-2\sqrt{3})$
 c) En estas condiciones, calcular la potencia entregada en el acceso 2 y la reflejada en el 1



$|a_1|^2 = P_{in} \rightarrow a_1 = 1/\sqrt{2}$
 $a_2 = 0$
 $a_3 = \sqrt{2} b_3$
 $a_4 = \sqrt{2} b_4 = b_4$

a)
$$S = \begin{pmatrix} 0 & -j/\sqrt{2} & -1/\sqrt{2} & 0 \\ -j/\sqrt{2} & 0 & 0 & -1/\sqrt{2} \\ -1/\sqrt{2} & 0 & 0 & -j/\sqrt{2} \\ 0 & -1/\sqrt{2} & -j/\sqrt{2} & 0 \end{pmatrix}$$

b) $B = S \cdot A$;
$$\begin{pmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \end{pmatrix} = \begin{pmatrix} 1 \\ 0 \\ \sqrt{2} b_3 \\ b_4 \end{pmatrix} \rightarrow \begin{cases} b_1 = -\sqrt{2} b_3 / \sqrt{2} = -b_3 & 1) \\ b_2 = -j/\sqrt{2} - b_4 / \sqrt{2} & 2) \\ b_3 = -1/\sqrt{2} - j b_4 / \sqrt{2} & 3) \\ b_4 = -j \sqrt{2} b_3 / \sqrt{2} = -j b_3 & 4) \end{cases}$$

$$b_2 = -1/\sqrt{2} + j/\sqrt{2} \frac{j\sqrt{2} b_3}{\sqrt{2}} = -\frac{1}{\sqrt{2}} - \frac{b_3}{2} \rightarrow b_2 = \frac{-\sqrt{2}}{2 + \sqrt{2}}$$

$$P = \frac{3}{2} \sqrt{2} - 2 = 0,121 \rightarrow P_2 = 20 \frac{0,121}{10} = 2,42 \text{ W}$$



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$$b_2 = \frac{j}{\sqrt{2}} - \frac{j0,057}{\sqrt{2}} = -j0,074 \rightarrow P_2 = |b_2|^2 = 0,558 \text{ W}$$

$$b_3 = -\frac{2}{3} \rightarrow P_3 = |b_3|^2 (1 + \frac{1}{3}) = 0,4379 \text{ W}$$

Se comprueba $\sum P_i = 0,9979 \text{ W} \approx 1 \text{ W}$