EE 481/581 Microwave Engineering
Quiz #7 (Fall 2025)

Name Key A

Instructions: Open book & notes. Place answers in given spaces and show all work for credit.

Design a lossless 80 Ω T-junction power divider with a 4:1 power split. First, find the fraction of the input power going to ports 2 and 3, i.e., P_2/P_1 and P_3/P_1. Next, find the impedances Z_1 (to port 2) and Z_2 (to port 3) to achieve this split. Then, design quarter-wave transformers for the arms going to ports 2 and 3 so that the impedances are converted to 80 Ω, i.e., find Z_{1t} (to port 2) and Z_{2t} (to port 3). Last, sketch the T-junction power divider with full labeling. You are not expected to find the arm lengths $\lambda_1/4$ and $\lambda_2/4$.

4:1 split ⇒ Total is 5 parts ⇒ $\frac{P_2}{P_1} = 4/5 = \underline{0.8}$

$P_3/P_1 = 1/5 = \underline{0.2}$

$Z_1 = \frac{Z_0}{P_2/P_1} = \frac{80}{0.8} = \underline{100\,\Omega}$

$Z_2 = \frac{Z_0}{P_3/P_1} = \frac{80}{0.2} = \underline{400\,\Omega}$

$\frac{1}{Z_1} + \frac{1}{Z_2} \stackrel{?}{=} \frac{1}{Z_0}$ (7.25)

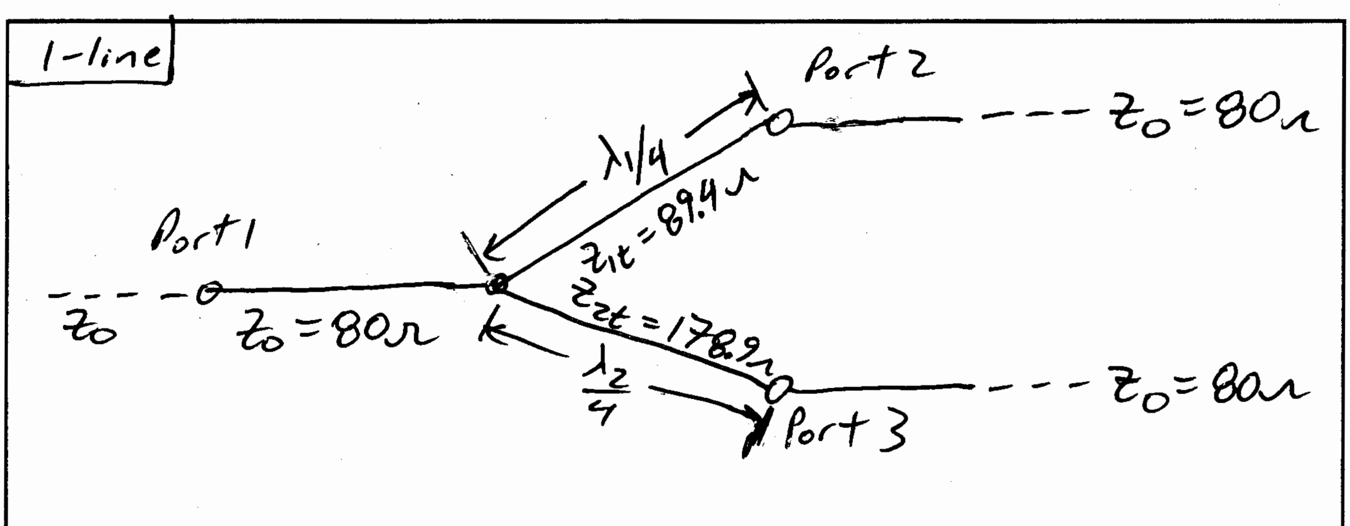
$\frac{1}{100} + \frac{1}{400} = 0.0125 = \frac{1}{80}$ ✓

(2.63) $Z_{1t} = \sqrt{Z_1 Z_0} = \sqrt{100(80)} = \underline{89.4427\,\Omega}$

$Z_{2t} = \sqrt{Z_2 Z_0} = \sqrt{400(80)} = 178.8854\,\Omega$

$P_2/P_1 =$ 0.8 $P_3/P_1 =$ 0.2

$Z_1 =$ 100 Ω $Z_2 =$ 400 Ω $Z_{1t} =$ 89.44 Ω $Z_{2t} =$ 178.89 Ω



EE 481/581 Microwave Engineering
Quiz #7 (Fall 2025)

Name Key B

Instructions: Open book & notes. Place answers in given spaces and show all work for credit.

Design a lossless 60 Ω T-junction power divider with a 4:1 power split. First, find the fraction of the input power going to ports 2 and 3, i.e., P_2/P_1 and P_3/P_1. Next, find the impedances Z_1 (to port 2) and Z_2 (to port 3) to achieve this split. Then, design quarter-wave transformers for the arms going to ports 2 and 3 so that the impedances are converted to 60 Ω, i.e., find Z_{1t} (to port 2) and Z_{2t} (to port 3). Last, sketch the T-junction power divider with full labeling. You are not expected to find the arm lengths $\lambda_1/4$ and $\lambda_2/4$.

4:1 split ⇒ Total is 5 parts ⇒ $P_2/P_1 = 4/5 = \underline{0.8}$

$P_3/P_1 = 1/5 = \underline{0.2}$

$Z_1 = \frac{Z_0}{P_2/P_1} = \frac{60}{0.8} = \underline{75\,\Omega}$

$Z_2 = \frac{Z_0}{P_3/P_1} = \frac{60}{0.2} = \underline{300\,\Omega}$

$\frac{1}{Z_1} + \frac{1}{Z_2} \stackrel{?}{=} \frac{1}{Z_0}$ (7.25

$\frac{1}{75} + \frac{1}{300} = 0.01\bar{6} = \frac{1}{60}$ ∴

(2.63) $Z_{1t} = \sqrt{Z_1 Z_0} = \sqrt{75(60)} = \underline{67.082\,\Omega}$

$Z_{2t} = \sqrt{Z_2 Z_0} = \sqrt{300(60)} = \underline{134.164\,\Omega}$

$P_2/P_1 =$ 0.8 $P_3/P_1 =$ 0.2

$Z_1 =$ 75 Ω $Z_2 =$ 300 Ω $Z_{1t} =$ 67.08 Ω $Z_{2t} =$ 134.16 Ω