**NEW YORK CITY COLLEGE OF TECHNOLOGY**

**TCET TELECOMMUNICATION ENGINEER DEPARTMENT**

**TCET 2220: TRANSMISSION SYSTEM**

**PROFESSOR: VIVIANA VLADUTESCU**

**SMITH CHART**

**FINAL PROJECT BY SALAM SECK**

**Project 1**

**Guidelines: Please type all the solutions! For the Smith Chart use Tools/ Typewriter to inset symbols or text. Email and UPLOAD your project 1 on your ePortfolio. In addition to this poject you also need to upload Project 2 and the reflections on the seminars/workshops/field trips, and email them to me.**

1. A 0.334λ long Z0=50 Ω T-line is terminated in a load ZL=100-j100 Ω. Calculate and use the Smith Chart to find:

a)ΓL;

**zL =** $\frac{ZL}{Z0 }$ **=** $\frac{100-J100}{50 }$ **= 2 – j2** $Ω$

**ΓL = 0.62; we determined it from the graph by projecting along the RADIALLY SCALED PARAMETERS.**

b)VSWR;

**From the same projection also we did find that the VSWR is equal to 4.25 (VSWR = 4.25).**

c)Zin seen by the source.

**Zin = (0.55 + j0.89) = 27.5 + j44.5**$ Ω$

1. Suppose a Z0=50 Ω T-line is is terminated in a 100 Ω load. Determine the aquired impedance of a quarter-wave matching section of T-line.

**Find Z1: Z1 =** $\sqrt{Z0 ZL}$ **=** $\sqrt{50 x 100}$ **= 70.71Ω**

1. Suppose a 50 Ω coaxial cable made with a Teflon dielectric, that must operate at 800MHz T-line is terminated in a ZL=10-j15 Ω. Use the Smith Chart to
2. Create a matching network by adding a reactive element at a suitable location along the T-line:

**ZL = 10 – j15Ω**

**F = 800MHz**

**Z0 = R0 = 50Ω**

**zL =** $\frac{ZL}{Z0}$ **=** $\frac{10-j15}{50}$ **= 0.2 – j0.3Ω**

1. determine the length of the coaxial line between the load and the capacitor:

**ynew = 1 - j1.95**

**d= 0.314λ – 0.201λ= 0.113λ**

**l= 0.5λ – 0.314λ = 0.186λ + 0.186λ = 0.372λ**

1. determine the value of the series capacitor added to provide an impedance match:

**1.95j = Xc**

**1.95j =** $\frac{j}{wc}$

**1.95j =** $\frac{j}{2πfc}$

**1.95 =** $\frac{1}{2πfc}$

**C =** $\frac{1}{1.95 (2π\left(800MHz\right))}$

**C = 1.02pf**

1. You would like to match a 170Ω load to a 50 Ω T-Line.



(a) Determine the characteristic impedance required for a quarter-wave transformer.

**R10 =** $\sqrt{50 x 170 }$ **= 92.19Ω**

**Zs = 92.19 [**$\frac{170+j92.19\tan((\frac{π}{2}))}{92.19+j170\tan((\frac{π}{2}))}$**]**

**Zs = 42.66Ω**

1. Consider a 6 cm long 75 Ω transmission line terminated in a 125 Ω load and having a matched source impedance (*Zs* = 25 Ω). Propagation velocity on the T-Line is 0.1*c*. The source is a 0.4 ns square pulse of amplitude 4V.

**V+1 =** $\frac{V0 Z0}{Zs+Z0}$ **=** $\frac{\left(4 \right)(125)}{25+125}$ **= 3.33V**

**VL =** $\frac{\left(V +1\right)\left(1+ ΓL\right)}{1-(Γs ΓL)}$ **=** $\frac{\left(3.33\right)(1+0.62)}{1-0}$ **= 5.39V**

**V-1= (V+1) (**$ΓL)$ **= (3.33) (0.62) = 2.06V**

**VOLTAGE STEADY STATE IS:**

**V+1 + V-1 = 3.33V + 2.06V = 5.39V**

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