**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.**

**Team 1:**  Mamadou Bah, Arie Meiman, Daniel Edwards and Tyrell Miles

1. A 690λ- long lossless Z0=75Ω T-line is terminated in in a load ZL=15+j67 Ω. Calculate and use the Smith Chart to find:
2. ΓL; b)VSWR; c)Zin
3. $ΓL=\frac{15+j67-75}{15+j67+75}=\frac{-60+j67}{90+j67}=\frac{89.9}{112.2}=0.8$
4. $VSWR=\frac{1+0.8}{1-0.8}=\frac{1.8}{0.2}=9$
5. The input impedance for a 100Ω lossless T-line of length 1.162λ is measured as 12+j42 Ω. Determine the load impedance.

Normalized input impedance🡪$z\_{in}=\frac{12+j42}{100}=0.12+j0.42$

Normalized load impedance🡪 $z2=0.32+j1.55$

Final Answer🡪 $Z2=100\left(0.32+j1.55\right)=32+j155$

1. a) Design an open ended shunt-stub matching network to match a load ZL =70+j110 Ω to a 50 Ω impedance T-line. Chose the solution that minimizes the length of the through line.

$$z\_{L}=\frac{70+j110}{50}=1.4+j2.2$$

Admittance: 0.32+j0.2

1+j1.3

1-j1.4

Length: 0.324λ

Distance:0.324\*2=0.648 meters

1. Now suppose the load turns out to be ZL =40+j100 Ω. Determine the reflection coefficient seen looking into the matching network.
2. A load impedance ZL=25+j90 Ω is to be matched to a 50 Ω line using a shorted shunt stub tuner. Find the solution that minimizes the length of the shorted stub

Normalized load impedance:

$$Z\_{L}=\frac{25+j90}{50}=0.5+j1.8$$

Admittance: YL=0.1+j0.5

1+jb=1+j2.6

1-jb=-j2.6

Wavelength from load: 5-0.422=0.078

Load λ + (1+jb) λ: 0.078 +0.172=0.25

Distance 1: 0.25\*2=0.5m

Distance 2: 0.25-0.192=0.058

Minimized length: 0.058\*2=0.116 m

Answer=0.116 meters

1. A 50 Ω line is terminated in a pair of parallel load impedances of 50+j100 Ω and 50 –j100 Ω. Determine the total load admittance and impedance seen by the line.
2. Consider the figure with the following values VS=10V, RS=30Ω, R0=50Ω, up=0.666c, RL=150Ω, and l=10cm. Plot out to 2ns
3. the voltage at the source end,

$$reflection of source=\frac{Z\_{S}-Z\_{0}}{Z\_{S}+Z\_{0}}=\frac{30-50}{30+50}=\frac{-20}{80}=-0.25$$

$$reflection of load=\frac{Z\_{L}-Z\_{0}}{Z\_{L}+Z\_{0}}=\frac{150-50}{150+50}=\frac{100}{200}=0.5$$

$$v\left(0,0\right)=\frac{50}{50+30}\*10=\frac{500}{80}=6.25 V$$

V+ =V- \*Γ

v+ = 3.125\*-0.25= 1.5625

v+ =-0.25\*0.7825=0.1953125

v+ =0.25\*0.09765625=0.0244140625

v+ =0.25\*0.01220703125=0.0030517578125

1. b) the voltage at the middle,

$\frac{v1(1+rL)}{1-rSrL}=\frac{6.25(1+0.5)}{1-\left(-0.25\right)(0.5)}=\frac{6.25\*1.5}{1+0.125}=\frac{9.375}{1.125}=8.33$ volts

1. the voltage at the load end of the T-line.

$$v\left(x,\infty \right)=\frac{150\*10}{50+150}=\frac{1500}{200}=7.5 V$$

V-=V+ \*Γ

v- = (0.5)\*6.25=3.125 volts

v- =0.5\*1.5625=.7825

v- = 0.5\*0.1953125=0.09765625

v- =0.5\*0.0244140625=0.01220703125