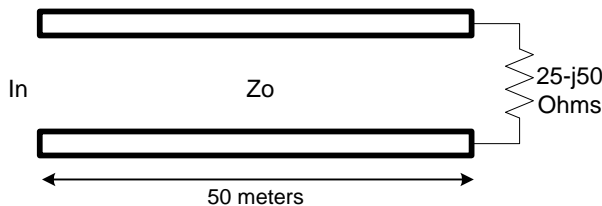


Instructions: This exam is closed book, except for one 8.5"x11" sheet of handwritten notes (as specified for exam I).

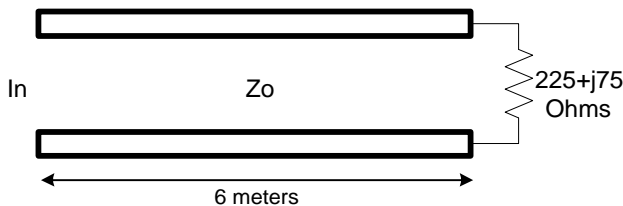
Coaxial Cables											
RG #	AWG Material	Insulation	# Shields	Jacket	Nom. O.D. (inch)	Nom. Imp. (Ohms)	Nom. Vel. Of Prop.	Nom. Cap. (pF/ft.)	Nom. Attenuation per 100'		Standard Spool Lengths
									MHz	dB	
14/U	20 Copper	Poly-ethylene	1	Black Vinyl	.420	95	66%	16.0	100 200 400	3.0 4.5 6.0	100, 500
14A/U	20 Copper	Poly-ethylene	1	Black Vinyl	.420	92	66%	16.0	100 200 400	3.5 5.0 7.0	100, 500
16A/U	18 Copper	Cellular Poly-ethylene	1	Black Vinyl	.195	50	78%	30.8	100 200 400	5.0 7.0 9.5	100,500 1000
18/U	18 Copper	Cellular Poly-ethylene	1	Black Vinyl	.280	75	78%	24	100 200 400	4.0 6.0 8.0	100,500 1000

Problem #1) A 50 meter long, lossy (coaxial) transmission line ($Z_o = 50 \Omega$, $\gamma = 0.005 + j0.02513$ /meter) is connected to a $25-j50 \Omega$ load and is supplied by an 828 kHz, r.f.-source. Determine the **input impedance** of the line **using a Smith Chart**. Note – if you are not able to determine the length of the line in wavelengths, you may use the value $.7\lambda$, but points will be deducted from your score.



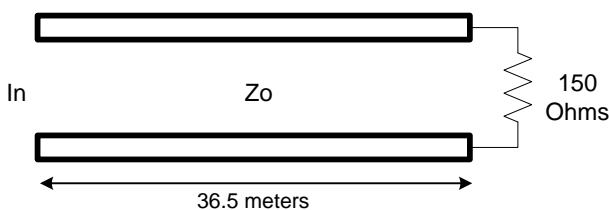
$Z_{in} = \underline{\hspace{2cm} 26.5+j16.5 \hspace{2cm}} \Omega$

Problem #2) A 6 meter long, lossy (coaxial) transmission line has the following characteristics:
 $Z_o = 75 \Omega$, $\gamma = 0.037 + j1.365$ (Np/m and rad/m respectively)
 The line is connected to a $225+j75 \Omega$ load and is supplied by an 43 MHz, r.f.-source. Determine the **input impedance** of the line **using a Smith Chart**.



$Z_{in} = \underline{\hspace{2cm} 37.5+j12.75 \hspace{2cm}} \Omega$

Problem #3) A 36.5 meter long, lossy transmission line has the following characteristics:
 $Z_o = 75\Omega$, $\gamma = 0.0189 + j19.04$ (Np/m and rad/m respectively)
 The line is connected to a 150Ω load and is supplied by a 600 MHz, r.f.-source. Determine the actual **input impedance** of the line.
You must use and completely LABEL the Smith Chart for your solution.



$Z_{in} = \underline{\hspace{4cm}} \Omega$

Multiple Choice and TRUE/FALSE

If a Smith Chart is used to determine the **input impedance** of a transmission-line terminated with a known load:

- a) the solution will require a rotation around the Smith Chart in the clock-wise direction
- b) the input impedance will be closer to the chart's center than the load impedance for a lossy line
- c) the plotted impedances must be normalized if the impedance value of the chart's origin (center point) is not equal to the line's characteristic impedance
- d) All of the above (a-c) are correct**

Given a transmission-line with known input impedance, solving for the **load impedance** connected to the receiving-end of the line requires a rotation on a Smith Chart:

- a) in the clockwise direction.
- b) in the counter-clockwise direction.**
- c) in a direction that is dependent on the initial input impedance value.
- d) that will reverse direction with every $\frac{1}{2}$ -wavelength of line length traveled.

A (lossless) **short-circuited stub** of length L:

- a) can appear as an open-circuit at its input depending on the length L.
- b) can appear as any desired inductance value at its input depending on the length L.
- c) can appear as any desired capacitance value at its input depending on the length L.
- d) All of the above choices (a-c) are correct.**

Given a lossy transmission line, the plotted position of the line's normalized **load-impedance** on a Smith Chart:

- a) will be in the top half of the chart for a "capacitive" load.
- b) will change is the line was actually lossless.
- c) will be further from the "origin" than the position of the line's normalized input impedance.**
- d) All of the above choices (a-c) are correct.

Compared to a $\frac{1}{4}$ -wavelength tuner, a **single-stub tuner**:

- a) always utilizes standard transmission-line impedance values (such as in table 1-3 of the text).
- b) can be used to match a complex load-impedance to a purely resistive source impedance.**
- c) will result in a better match for a purely real load to a purely real source impedance.
- d) All of the above choices (a-c) are correct.

True The **magnitude** of the **reflection coefficient** due to a load impedance on a transmission-line relates to the distance from the normalized load impedance to the center of the Smith Chart.

True The **circle** that provides the outer-boundary of the impedance portion of the Smith Chart defines a set of impedance points all of which have real values of zero (purely imaginary impedances).

False The set of normalized load impedances defined by a circle centered at the origin of a Smith Chart will all result in the same **reflection coefficient** on the transmission-line.

True The set of normalized load impedances defined by a circle centered at the origin of a Smith Chart will all result in the same **VSWR** on the transmission-line.

False The point with the **largest impedance magnitude** within a set of impedances defined by a circle centered about the Smith Chart's origin will be the "left-most" point on the circle.

False Adding $\frac{1}{2}$ **wavelength** of line to a transmission-line terminated by a load will effectively cause an additional rotation of $\frac{1}{2}$ -revolution during the solution of the problem on a Smith Chart.

True A **rotation** in the "clock-wise" direction around a Smith Chart relates to a movement on a transmission line from a "known impedance" location towards the "sending end" of the line.

True To account for **losses** on a transmission line when using a Smith Chart to solve for an unknown impedance, both a rotation and a change in the distance from the origin are required.

True All of the impedances shown on the **top half** (above but **not** including the horizontal axis) of a Smith Chart have a (non-zero) **inductive reactance** component.

True Given an impedance plotted on a Smith Chart, the **admittance** value of the plotted impedance may be determined by drawing a circle centered at the origin that passes through the impedance point and then finding the point that is 180° around the circle from the plotted impedance.