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| **Benha University****Faculty of Engineering at Shoubra****Electrical Engineering Department** | **she3ar** | **Microwave fundamentals****3rd Year Communications****(2013-2014)** |

**Sheet 2 (***2 weeks***)**

$$ A lossless transmission line is terminated with a 100 Ω load. If the SWR on the line is 1.5, find the two possible values for the characteristic impedance of the line.

$$ Let Zsc be the input impedance of a length of coaxial line when one end is short-circuited and let Zoc be the input impedance of the line when one end is open-circuited. Derive an expression for the characteristic impedance of the cable in terms of Zsc and Zoc.

$$ A 100 Ω transmission line has an effective dielectric constant of 1.65. Find the shortest open-circuited length of this line that appears at its input as a capacitor of 5 pF at 2.5 GHz. Repeat for an inductance of 5 nH.

 $$ A radio transmitter is connected to an antenna having an impedance 80 + j40 Ω with a 50 Ω coaxial cable. If the 50 Ω transmitter can deliver 30 W when connected to a 50 Ω load, how much power is delivered to the antenna?

$$ The transmission line circuit shown below has Vg= 15 V rms, Zg=75 Ω, Zo =75 Ω, ZL= 60- j40Ω, and $l$ = 0.7λ. Compute the power delivered to the load using three different techniques:

1. find Γ and compute



1. find Zin and compute



1. find VL and compute



1. Discuss the rationale for each of these methods. Which of these methods can be used if the line is not lossless?



$$ For a purely reactive load impedance of the form ZL= jX, show that the reflection coefficient magnitude lf I Γ I is always unity. Assume the characteristic impedance Zo is real.

$$ Consider the transmission line circuit shown below. Compute the incident power, the reflected power, and the power transmitted into the infinite 75 Ω line. Show that power conservation is satisfied.



$$ A generator is connected to a transmission line as shown below. Find the voltage as a function of z along the transmission line. Plot the magnitude of this voltage for

$-l$ $\leq $ Z $\leq $ 0



**Good Luck**

**Dr. Gehan Sami**