

## ENEL 476 – Assignment #4

Due at 4 pm on Monday April 13, 2015

Drop boxes on 2<sup>nd</sup> floor of ICT

### Question 1

A load of impedance  $Z_L = 70 + j25 \, \Omega$  is attached to a transmission line with  $100 \, \Omega$  characteristic impedance ( $Z_0 = 100 \, \Omega$ ). The frequency of operation is 900 MHz and the wavelength on the line is 67 cm.

- Find the reflection coefficient at the load ( $\Gamma$ ).
- Find the standing wave ratio,  $s$ .
- Find the input impedance  $Z_{in}$  when a line of length of 25 cm is attached to the load.
- Design a series stub tuner with an open termination on the stub, and a shunt stub tuner with a short termination on the stub.

### Question 2

An antenna is to be connected to a transmission line with  $100 \, \Omega$  impedance ( $Z_0 = 100 \, \Omega$ ).

A slotted line is used to characterize the antenna behaviour. With a short attached, the voltage minima are located at 2, 5 and 8 cm. With the antenna attached, these minima shift to 2.5, 5.5 and 8.5 cm. The standing wave ratio is 4. The velocity of propagation is  $0.8c$  (where  $c = 3 \times 10^8 \, \text{m/s}$ ).

- Find the operating frequency.
- Find the impedance of the antenna.
- Design a quarter-wavelength transformer to match the antenna to the transmission line. Indicate the location relative to the load, the length of line assuming velocity of propagation is  $0.8c$ , and the impedance of the quarter-wavelength section of line.
- Design a shunt stub tuner to match the antenna to the line. Select the shorted stub with the minimum length.