Indian Institute of Technology, Delhi
EEL202: Circuit Theory
Minor 2, October 5, 2013

Attempt to answer question 2 only after you are done with question 1.

1. A transmission line of characteristic impedance Z_0, and length d, is terminated with an impedance Z_L. What is the expression for the input impedance? (Refer to Fig. 1.) If Z_L is an open circuit, find the expression for the input impedance. If Z_L is a short circuit, find the expression for the input impedance. (3+1+1 marks)

2. A circuit is designed using an open circuit stub and a short circuit stub, as shown in Fig. 2. (An open circuit stub is a transmission line of characteristic impedance Z_0 terminated with an open circuit. Likewise, a short circuit stub is a transmission line terminated with a short circuit.) Find the system transfer function, $H(j\omega)$ as a function of ω. Plot $|H(j\omega)|$ as a function of ω. Is this a low pass or a high pass filter? (For this question, assume the velocity of a wave through the transmission line is 3×10^8 meters/second.) (4+2+1 marks)

3. In Fig. 3, the current source is voltage-controlled, with a value of 20 mS$\cdot V_C$, where V_C is as indicated. For a reference impedance of 50 Ω, find the scattering matrix for the network at a frequency of 1 Grad/sec. (4×2 marks) $= 10^9$ rad/sec.

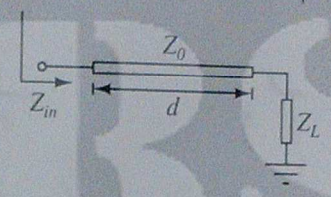

Figure 1: Transmission line of length d terminated with Z_L.

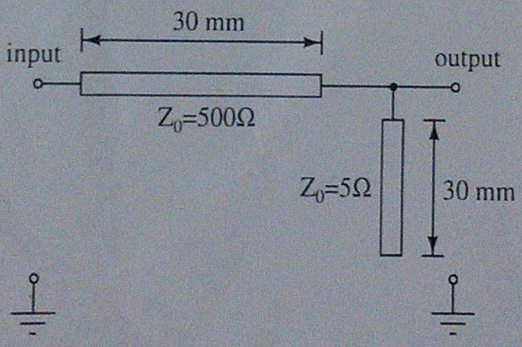

Figure 2: Circuit using open and short stubs.

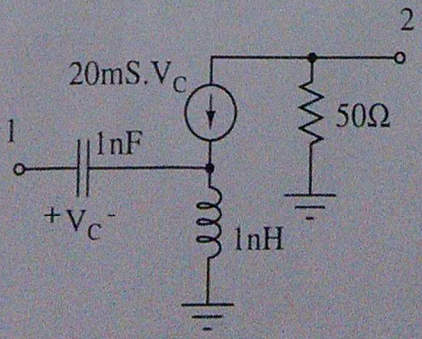

Figure 3: Two port network.