

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 $20 \text{ mS} \cdot V_C$, where V_C is as indicated. For a reference impedance of 50Ω , find the scattering matrix for the network at a frequency of 1 Grad/sec. (4×2 marks)

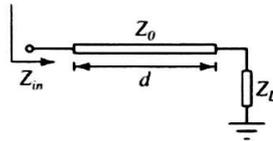


Figure 1: Transmission line of length d terminated with Z_L .

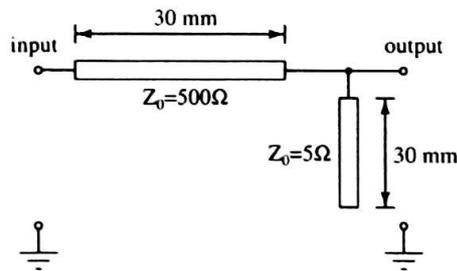


Figure 2: Circuit using open and short stubs.

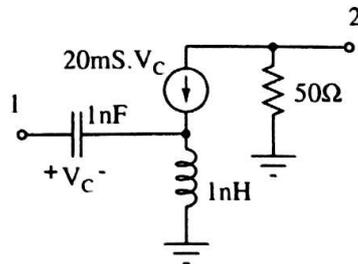


Figure 3: Two port network.