



Indian Institute of Information Technology, Kalyani
Dept. of Electronics and Communications
RF And Microwave Engineering
Laboratory Assignments

Timing: 02:00 to 05:00 PM

Autumn 2024, 7th Semester

Max marks: 40

Softwares Allowed: Scilab/MATLAB

1. (a) Determine the input impedance, reflection coefficient, and VSWR of a lossless transmission line for a given characteristic impedance, load impedance, phase constant and length.
(b) Plot the normalized input impedance of a lossless transmission line terminated with a short-circuit and open-circuit.
2. (a) Determine the impedance and length (in cm) at the operating frequency f_0 of the single-section quarter-wave transformer to match a real load Z_L to a lossless transmission line with a characteristic impedance Z_0 .
(b) Plot the magnitude of the reflection coefficient versus normalized frequency f/f_0 for a single-section quarter-wave transformer where f/f_0 varies from 0 to 4.
(c) Plot the magnitude of the reflection coefficient versus electrical length l for a single-section quarter-wave transformer where l varies from 0 to $\lambda/4$.
(d) Plot the magnitude of the reflection coefficient versus normalized frequency f/f_0 for a single-section quarter-wave transformer for $Z_L/Z_0 = 2, 5$, and 10 where f/f_0 varies from 0 to 2.
(e) Determine the percent fractional bandwidth of a single-section quarter-wave transformer network where the maximum acceptable SWR is S_m .
3. (a) An L-section impedance matching network is inserted between a transmission line with a characteristic impedance Z_0 and a load impedance $Z_L = R_L + jX_L$. The frequency of operation is f_0 . Determine the values of the lumped elements L and C . Note that there are two possible solutions.

- (b) A short-circuited single-stub impedance matching network is inserted between a transmission line with a characteristic impedance Z_0 and a load impedance $Z_L = R_L + jX_L$ ($R_L > Z_0$). Determine the stub distance d from the load and the stub length l . Note that there are two possible solutions.
4. (a) Determine the ABCD-matrix of the T-network. Determine if the network is a reciprocal and symmetrical network.
- (b) Write a MATLAB program to determine the ABCD-matrix of the π -network. Determine if the network is a reciprocal and symmetrical network.
- (c) Determine the S-matrix of the T-network. The network is matched with a characteristic impedance of $Z_0 = 50 \Omega$.
- (d) The S-matrix of a three-port network is given below. Determine if the network is a reciprocal and lossless network. Determine the return loss (RL) at port 1 when all other ports are terminated with matched loads, and the insertion loss (IL) between port 2 and port 3 when all other ports are terminated with matched loads.

Best wishes