ELC 4383 – RF/Microwave Circuits I

Chapter 8 Supplemental Homework

S8.1. Design a maximally flat low-pass filter with a cutoff frequency of 1 GHz, and an attenuation of at least 20 dB at 1.7 GHz. The characteristic impedance is 50 Ω. Use a series inductor as the filter element closest to the source. Draw the filter with all inductor and capacitor values clearly labeled.

S8.2. Design a maximally flat low-pass filter with a cutoff frequency of 2 GHz, and an attenuation of at least 30 dB at 6 GHz. The characteristic impedance is 50 Ω. Use a shunt capacitor as the filter element closest to the source. Draw the filter with all inductor and capacitor values clearly labeled.

S8.3. Design a 0.5 dB equal-ripple low-pass filter with a cutoff frequency of 1.5 GHz, and an attenuation of at least 20 dB at 2.25 GHz. The characteristic impedance is 50 Ω. Use a series inductor as the filter element closest to the source. Draw the filter with all inductor and capacitor values clearly labeled.

S8.4. Design a bandpass, 0.5 dB equal-ripple, lumped-element filter having a center frequency of 2 GHz and a bandwidth of 10 percent. The characteristic impedance is 50 Ω. Choose the minimum number of sections such that the attenuation is greater than 10 dB at 2.124 GHz. Use a series network to represent the filter element closest to the source. Draw the filter with all capacitor and inductor values, as well as the load impedance, clearly labeled.

S8.5. Design a bandpass, 3 dB equal-ripple, lumped-element filter having a center frequency of 1 GHz and a bandwidth of 15 percent. The characteristic impedance is 50 Ω. Choose the minimum number of sections such that the attenuation is greater than 30 dB at 1.136 GHz. Use a shunt network to represent the filter element closest to the source. Draw the filter with all capacitor and inductor values, as well as the load impedance, clearly labeled.

S8.6. Design a bandpass, 0.5-dB equal-ripple, lumped-element filter having a center frequency of 1.5 GHz and a bandwidth of 15 percent. The characteristic impedance is 50 Ω. Choose the minimum number of sections such that the attenuation is greater than 20 dB at 1.704 GHz. Use a series network to represent the filter element closest to the source. Draw the filter with all capacitor and inductor values, as well as the load impedance, clearly labeled.

S8.7. Design a stepped-impedance, 4th order, maximally flat low-pass filter having a cutoff frequency of 3 GHz and an attenuation of at least 20 dB at 4.5 GHz. Use a reference impedance of $Z_0 = 50\ \Omega$. The highest practical line impedance is 120 Ω, and the lowest is 30 Ω. Use a high-impedance line for the first section (closest to the source) and use the minimum number of sections capable of meeting the attenuation requirement, according to the appropriate figure in the textbook. Draw a schematic for the filter with the electrical length (in degrees) and characteristic impedance of each transmission line section clearly labeled. Clearly specify the necessary load resistance value in Ohms.

S8.8. Design a stepped-impedance, 0.5 dB equal-ripple flat low-pass filter having a cutoff frequency of 3 GHz and an attenuation of at least 10 dB at 3.9 GHz. Use a reference impedance of $Z_0 = 50\ \Omega$. The highest practical line impedance is 100 Ω, and the lowest is 30 Ω. Use a low-impedance line for the first section (closest to the source) and use the minimum number of sections capable of meeting the attenuation requirement, according to the appropriate figure in the textbook. Draw a schematic for the filter with the electrical length and characteristic impedance of each transmission line section clearly labeled. Clearly specify the necessary load resistance value in Ohms.

S8.9. Design a stepped-impedance, 0.5 dB equal-ripple flat low-pass filter having a cutoff frequency of 2 GHz and an attenuation of at least 10 dB at 2.6 GHz. Use a reference impedance of $Z_0 = 50\ \Omega$. The highest practical line impedance is 110 Ω, and the lowest is 25 Ω. Use a high-impedance line for the first section (closest to the source) and use the minimum number of sections capable of meeting the attenuation requirement, according to the appropriate figure in the textbook. Draw a schematic for the filter with the electrical length and characteristic impedance of each transmission line section clearly labeled. Clearly specify the necessary load resistance value in Ohms.