

VE215 Lab 5

Filter Lab

Data Sheet

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Date: 11.12 TA's Signature: Tw

Note: You will get grade deductions if you violate the following rules:

1. You are required to sign in the Logbook once you get your seat.
2. You are supposed to restore all the equipment and materials before you leave the lab.
3. You mustn't move any of the equipment and the material without TA's permission.

Procedures:

1. According to the pre-lab assignments, you are supposed to fill in the **Expected Data** columns in the tables below before the lab.
2. During the lab:
 - i) Construct the circuit for each type of filter. Resistor: $R = 982\Omega$; Capacitor: $C = 0.1\mu F$; Inductor: $L = 1mH$.
 - ii) Set the Input Signal in the function generator to be **Sine Wave** with amplitude of $5 V_{ppk}$ and **change the frequency** accordingly.
 - iii) Use the oscilloscope to detect the **amplitudes** of the **Input and Output** signals. Record them respectively in the first two column in the tables.
 - iv) Additionally for the **Band-reject Filter**, when the frequency approach the critical frequency at which the **Transfer Function Magnitude** reaches its minimum, the **Output Signal Amplitude** changes rapidly. For a more accurate result, you can (but not strictly required to) add some more rows to record the data (**Table V**).
3. After the lab, you should calculate with the experimental data for the "**Transfer function magnitude**" and "**Transfer function magnitude, in dB**" columns.

I) Low-pass Filter

Frequency	Input signal amplitude, Vppk	Output signal amplitude, (m)Vppk	Transfer function magnitude	Expected transfer function magnitude	Transfer function magnitude, in dB	Expected transfer function magnitude, in dB
1 MHz	4.8	32	0.0067	0.0016	-43.5218	-55.8058
100 kHz	4.8	137	0.0285	0.0162	-30.8904	-35.8070
50 kHz	4.9	253	0.0516	0.0324	-25.7415	-29.7898
10 kHz	4.9	1200	0.2449	0.1600	-12.2203	-15.9184
5 kHz	4.9	2200	0.4490	0.3084	-6.9555	-10.2191
1 kHz	5.1	4900	0.9608	0.8510	-0.3475	-1.4010
500 Hz	5.2	5700	0.9808	0.9556	-0.1687	-0.3948

II) High-pass Filter

Frequency	Input signal amplitude, Vppk	Output signal amplitude, Vppk	Transfer function magnitude	Expected transfer function magnitude	Transfer function magnitude, in dB	Expected transfer function magnitude, in dB
1 MHz	4.7	5600	1.1915	1.00	1.5218	0
100 kHz	4.8	5600	1.6667	0.9999	1.3389	-0.0011
50 kHz	4.9	5600	1.1429	0.9995	1.1598	-0.0045
10 kHz	4.9	5500	1.1224	0.9871	1.0033	-0.1126
5 kHz	4.9	5110	1.0429	0.9513	0.3645	-0.4339
1 kHz	5.1	2490	0.4882	0.5251	-6.2274	-5.5951
500 Hz	5.2	1330	0.2558	0.2948	-11.8430	-10.6095
100 Hz	5.1	279	0.0547	0.0616	-25.2393	-24.2097

III) Band-pass Filter

Frequency	Input signal amplitude, Vppk	Output signal amplitude, (m)Vppk	Transfer function magnitude	Expected transfer function magnitude	Transfer function magnitude, in dB	Expected transfer function magnitude, in dB
1 MHz	5.0	580	0.1160	0.1545	-18.7108	-16.2240
500 kHz	5.0	1650	0.3300	0.2986	-9.6297	-10.4981
100 kHz	4.9	4900	1.0000	0.8484	0.0000	-1.4275
50 kHz	4.8	5400	1.2500	0.9610	1.0231	-0.3455
10 kHz	4.8	5500	1.1458	0.9952	1.1824	-0.0418
1 kHz	5.1	2410	0.4725	0.5265	-6.5111	-5.5716
500 Hz	5.1	1290	0.2529	0.2951	-11.9396	-10.6009

IV) Band-reject Filter

Frequency	Input signal amplitude, Vppk	Output signal amplitude, (m)Vppk	Transfer function magnitude	Expected transfer function magnitude	Transfer function magnitude, in dB	Expected transfer function magnitude, in dB
1 MHz	5.0	5800	1.1600	0.9880	1.2892	-0.1049
500 kHz	5.0	5600	1.1200	0.9564	0.9844	-0.4056
300 kHz	5.0	5200	1.0400	0.8863	0.3407	-1.0481
200 kHz	4.9	4600	0.9388	0.7860	-0.5488	-2.0911
100 kHz	4.8	3930	0.6104	0.5292	-4.2875	-5.5282
50 kHz	4.8	1490	0.3104	0.2763	-10.1611	-11.1721
10 kHz	4.9	840	0.1714	0.0976	-15.3183	-20.2092
5 kHz	4.9	1970	0.4020	0.2804	-7.9146	-11.0435
1 kHz	5.1	4900	0.9608	0.8501	-0.3475	-1.4105
500 Hz	5.2	5100	0.9808	0.9555	-0.1687	-0.3956

Theoretically find the corresponding frequency when the output signal amplitude reaches its minimal value and fill in the following table:

V) Band-reject Filter (Not Strictly Required)

[illegible]