Lecture 36: Filters IV – Filter Design Problems

Upcoming events

1. Problem Set # 7 due Lesson 37
2. Quiz # 6 Lesson 37
3. GR # 3 Lesson 38

OBJECTIVES:

1. Demonstrate understanding by working filter design examples

READING

Required : Filters Handout (Available on Sharepoint), pgs 39–45

HOMEWORK

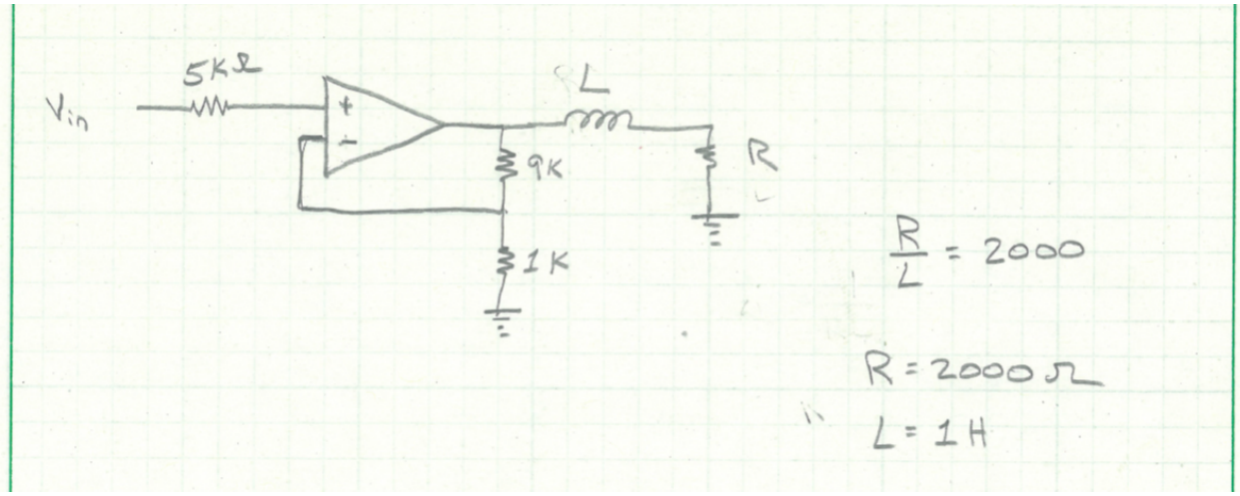
Recommended textbook problems : 5–1 (Handout)

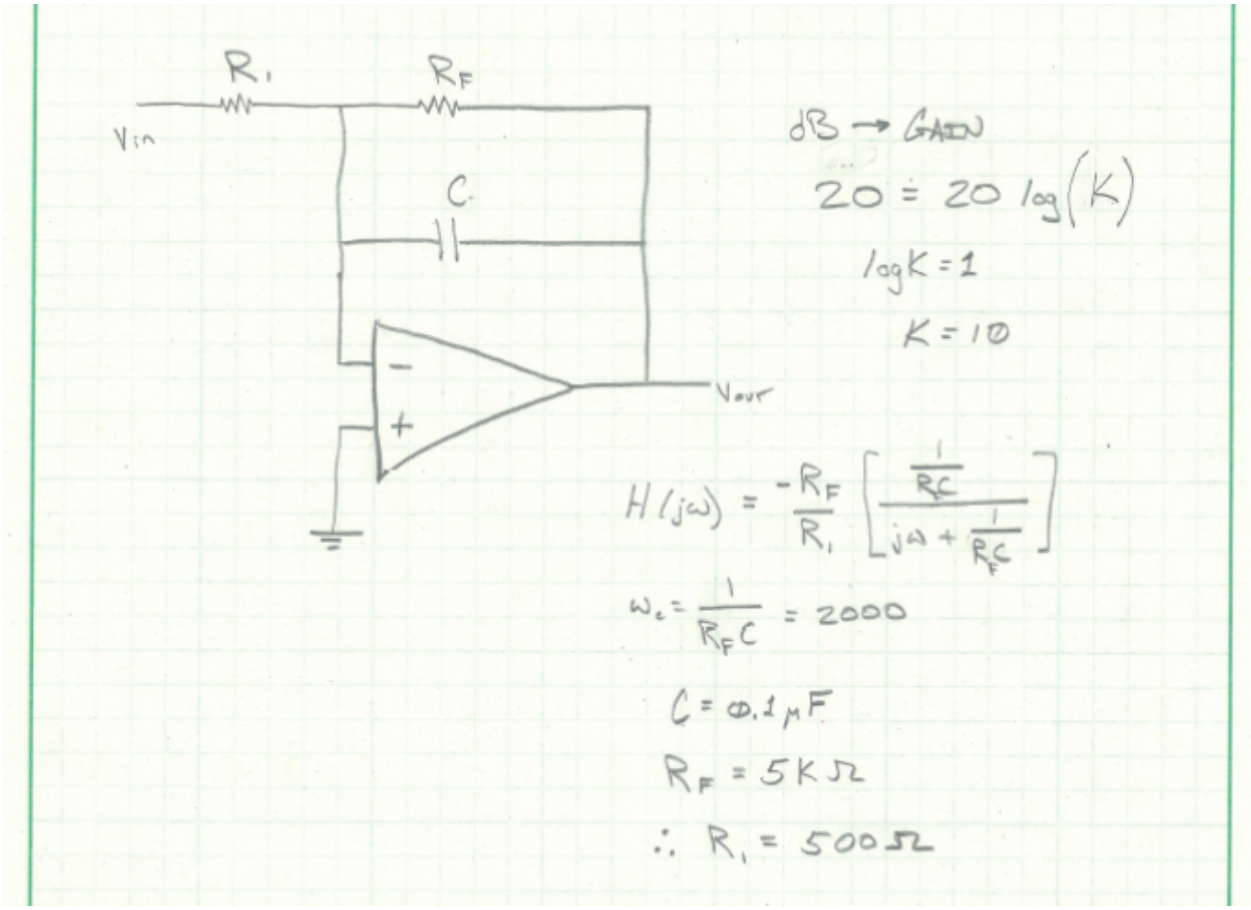
This lesson is dedicated to doing example problems (board work). Recommend you work on the board as I move around and help, but please copy the solution in your notes so you have access later.

1 Example 1 – Low Pass Filter

Given: We require a low-pass filter with a cut-off frequency of 2000 rad/sec and a passband gain of 20 dB. Additionally, the filter must connect to a source with a Thevenin resistance of 5 $k\Omega$.

Find: Design a circuit that meets the specifications.

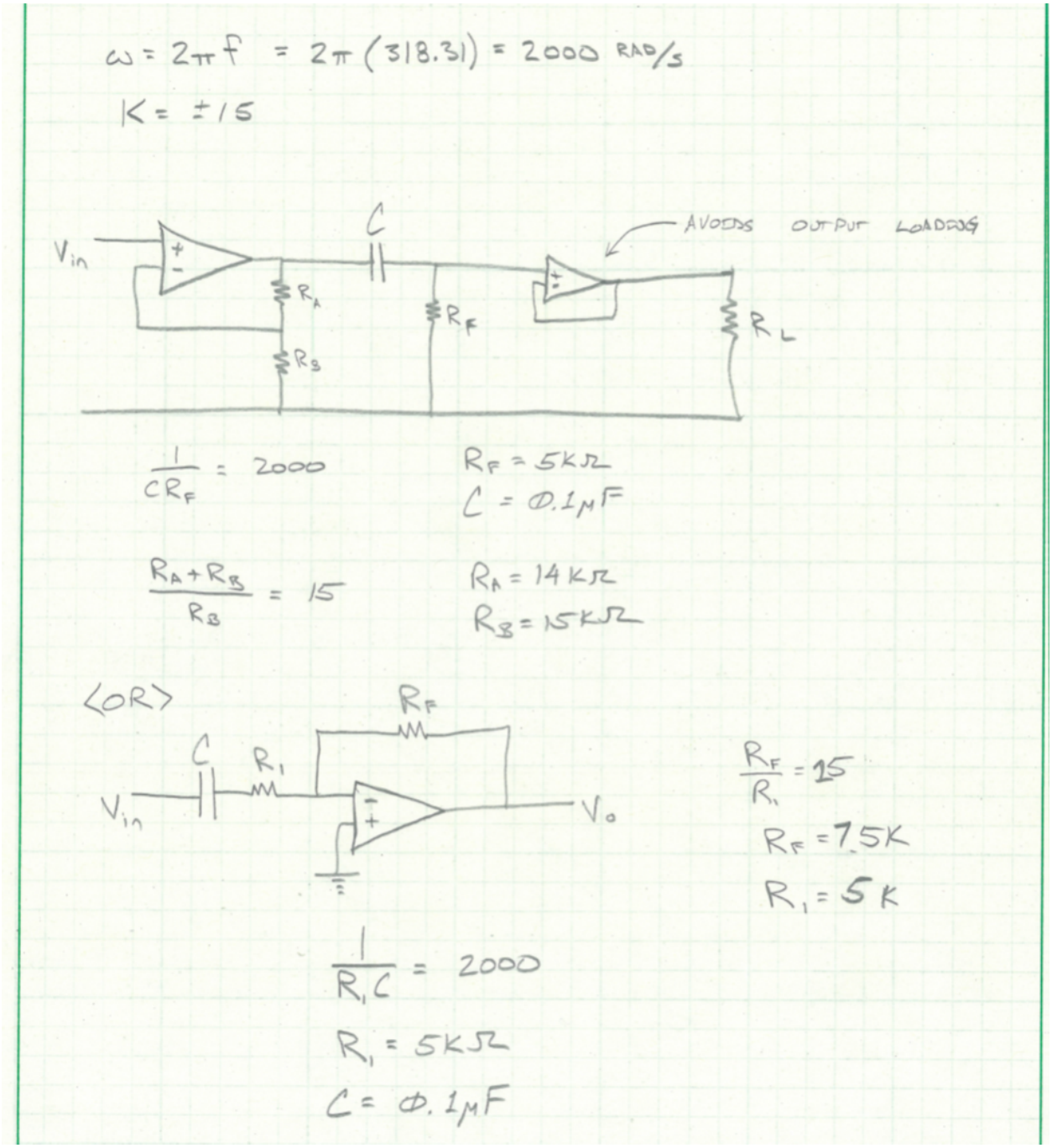



R1
RF
Vin
C
Vout
dB → GAIN
20 = 20 log(K)
log K = 1
K = 10
H(jω) = -RF/R1 [1/RFC / jω + 1/RFC]
ωc = 1/RFC = 2000
C = 0.1 μF
RF = 5 KΩ
∴ R1 = 500Ω

2 Example 2 – High Pass Filter

Given: We require a high-pass filter with a cut-off frequency of 318.31 Hz and a passband gain of ± 15. Additionally, the filter must connect to a load with a resistance of 10 $k\Omega$.

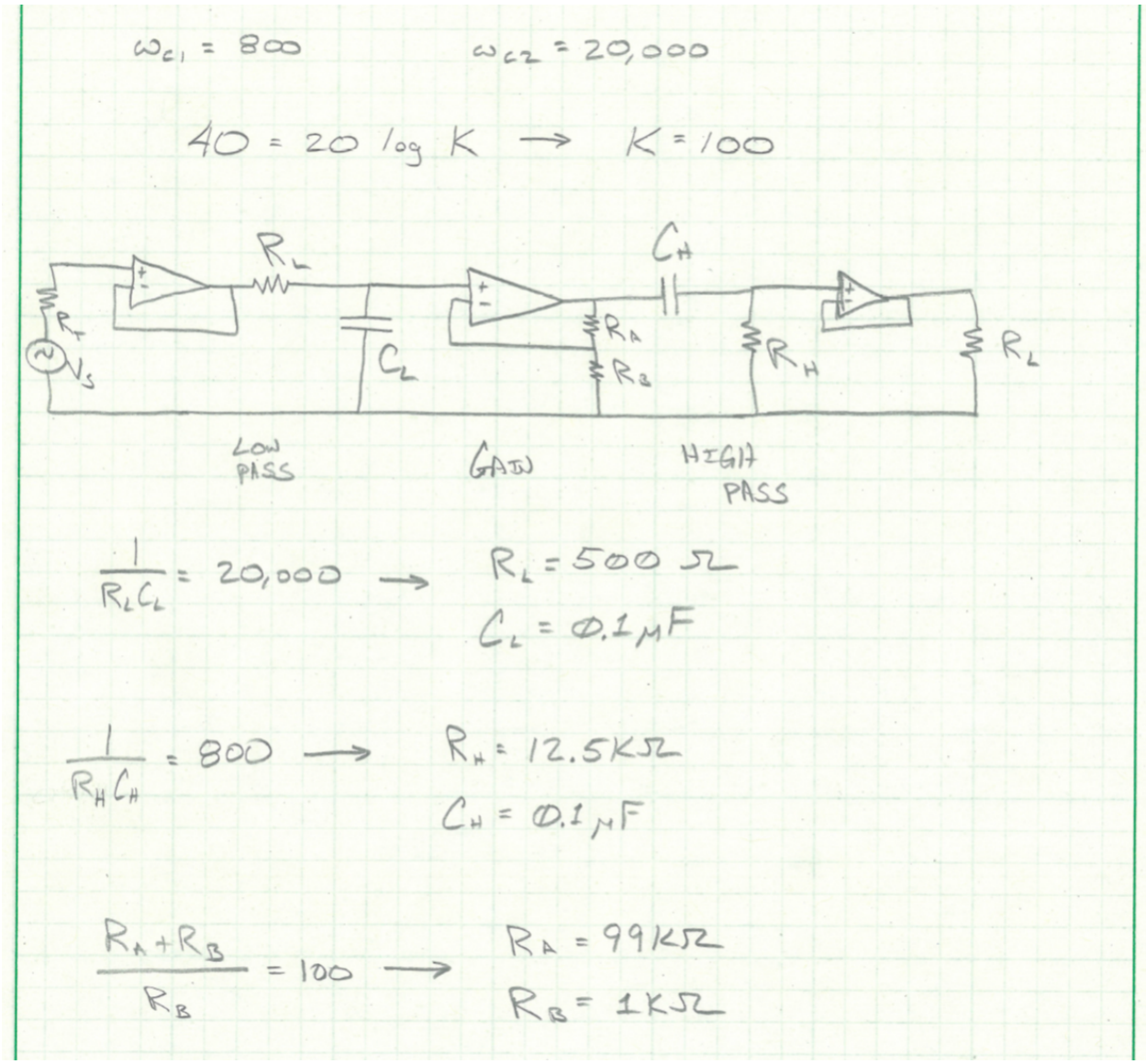
Find: Design a circuit that meets the specifications.



3 Example 3 – Band Pass Filter

Given: We require a band-pass filter with a low cut-off frequency of 800 rad/sec, a high cut-off frequency of 20000 rad/sec, and a passband gain of 40 dB. Additionally, the filter must connect to a source with a Thévenin resistance of 10 $k\Omega$ and a load with a resistance of 20 $k\Omega$.

Find: Design a circuit that meets the requirements.



4 Example 4 – Band Reject Filter

Given: We require a band-reject filter with a low cut-off frequency of 800 rad/sec, a high cut-off frequency of 20000 rad/sec, and a passband gain of ±100.

Find: Design a circuit that meets the requirements.