EECE 2150 - Circuits and Signals: Biomedical Applications Fall 2018, Quiz 8

Prof. Charles A. DiMarzio

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Student Name: _____

The top figures show the transfer function of some active filter.

1. Looking at the curves, how can you tell that it is an active filter?

_____

_____

2. What is the "passband" gain as a voltage ratio (not dB)?

$A_v =$ _____

3. What is the cutoff frequency?

$f_c =$ _____ Hz

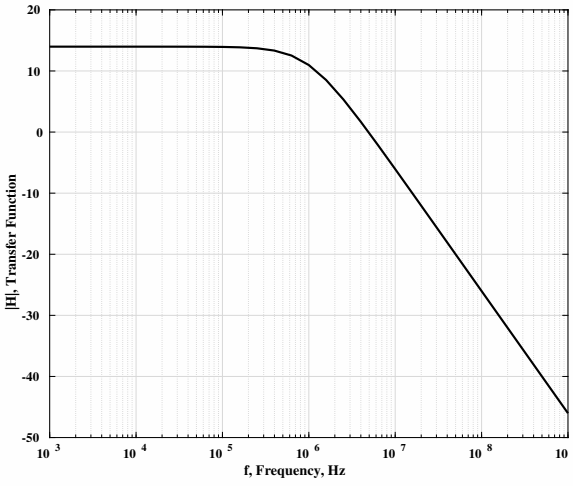
4. The time constant is determined by a parallel RC circuit.

$C = 2\,\text{nF}$. What is R?

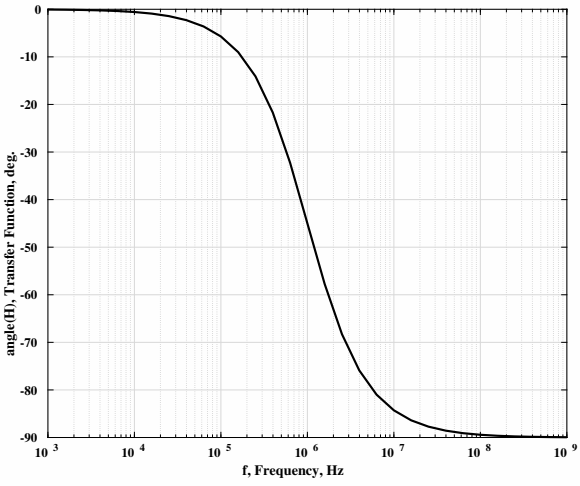
$R =$ _____ Ω

5. The remaining figures show input and output voltages as functions of time for this filter. Which of the figures are correct? It might help to put a dot on the transfer function at the right frequency.

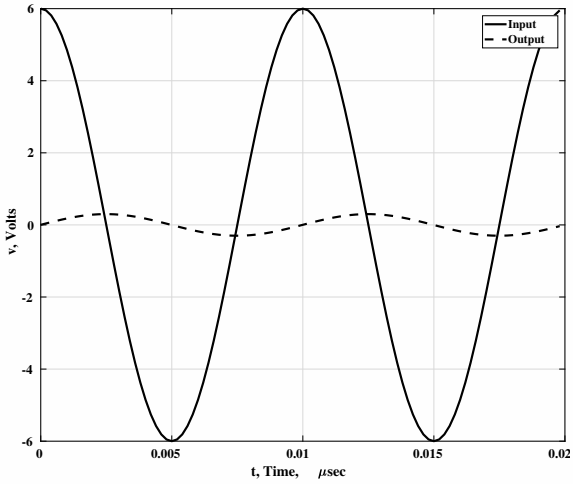
A ☐ B ☐ C ☐ D ☐



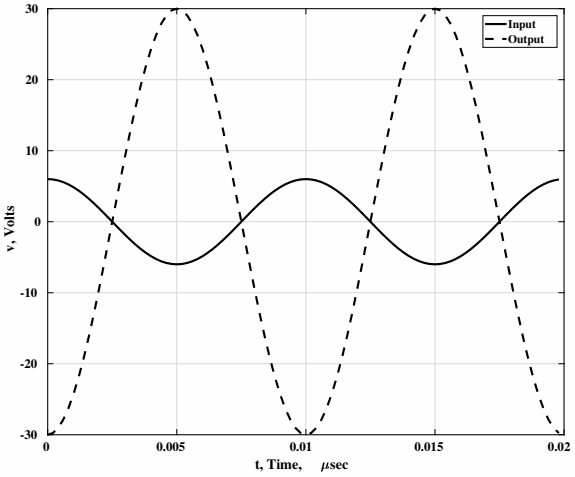
H Amplitude, dB



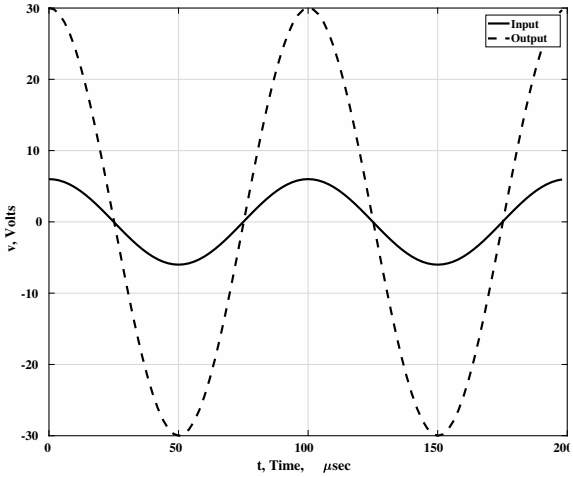
Phase, deg.



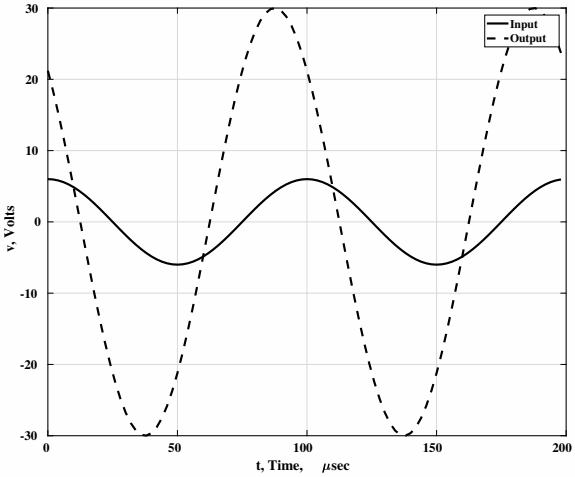
A



B



C

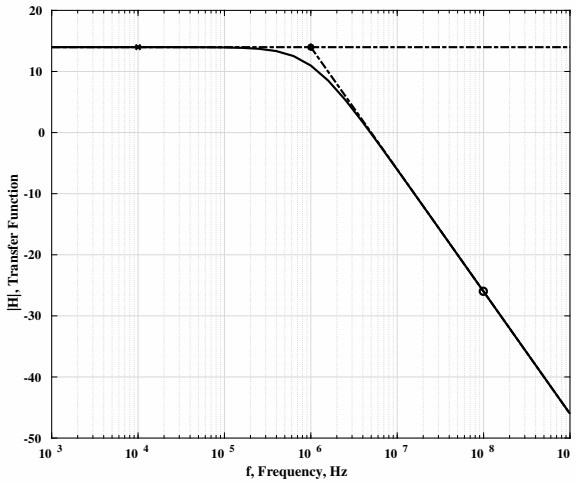


D

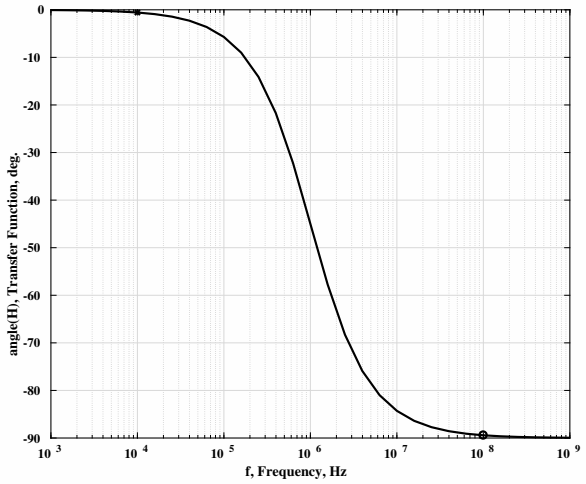
1. The maximum gain is greater than one so it must be active.

2. The "passband" is low, all the way to DC, and the gain is 14 dB or a magnitude of 5. The phase is zero so the gain is plus 5.

3. Draw the 20dB/octave line and it intersects the low–frequency gain at $f_c =$ 1



H Amplitude, dB



Phase, deg.

4.

$$\tau = 1/\omega = \frac{1}{2\pi f_c}$$

$$RC = \frac{1}{2\pi f_c} = 0.16\,\mu\text{s}$$

$$R = \tau/C = 79.5\,\Omega$$

5.

A (o on plots at 100 Mhz) is correct.

B (same frequency) is wrong. The gain is the DC gain and the phase is wrong.

C (x on plots at 10 kHz) is correct. The frequency is low so the output gain is about 5 and the phase is close to zero degrees.

D (same frequenc) is wrong. The gain is right but there is a phase shift that is inconsistent with the zero phase at low frequencies.