

ECE 2210 homework # 14

b

- Read the *Frequency Response, Filters & Bode Plots* handout and/or section 5.4 in your textbook (p.238).
- Convert the following ratios to dB. 4, 1/4, 500, 20000 Example: ratio = 12 $20 \cdot \log(12) = 21.6 \text{ dB}$
- Convert 20 dB, 46 dB, -46 dB and 80 dB to voltage ratios. Example: 50 dB, voltage ratio = $10^{\frac{50}{20}} = 316.23$

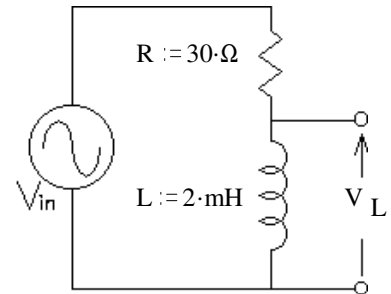
Please use semilog paper (provided separately) to draw the answers to 4 & 5.

- Draw the asymptotic Bode plot (the straight-line approximation) of the filter circuit shown. Accurately draw it on the graph paper provided. V_{in} is the input and V_L is the output of this circuit.

b) The asymptotic Bode plot is not exact. Sketch the actual magnitude of the transfer function on the same plot.

c) Calculate the actual magnitude of the transfer function at the corner frequency. (ω_c)

d) Calculate the actual magnitude of the transfer function at one octave above the corner frequency. $(2 \cdot \omega_c)$



- Draw the asymptotic Bode plot (the straight-line approximation) of the following transfer functions.

$$a) H_a(\omega) := \frac{20}{1 + j \cdot \frac{\omega}{4000 \cdot \frac{\text{rad}}{\text{sec}}}}$$

$$b) H_b(\omega) := \frac{120 \cdot j \cdot \omega}{400 \cdot \frac{\text{rad}}{\text{sec}} + j \cdot 4 \cdot \omega}$$

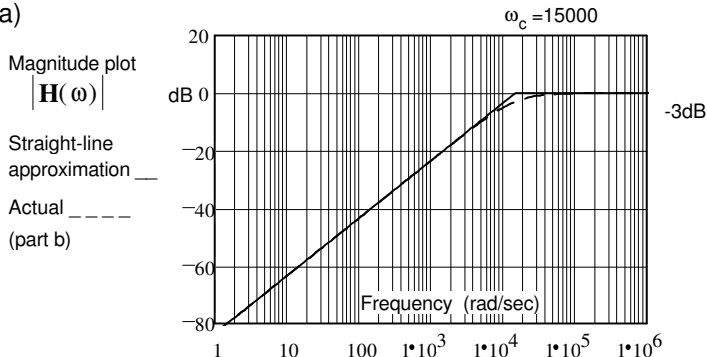
$$c) H_c(f) := 0.1 \cdot \frac{1 + j \cdot \frac{f}{200 \cdot \text{Hz}}}{1 + j \cdot \frac{f}{20000 \cdot \text{Hz}}}$$

- Determine the type of each of the filters in problems 4 and 5, low-pass, band-pass, or high-pass.

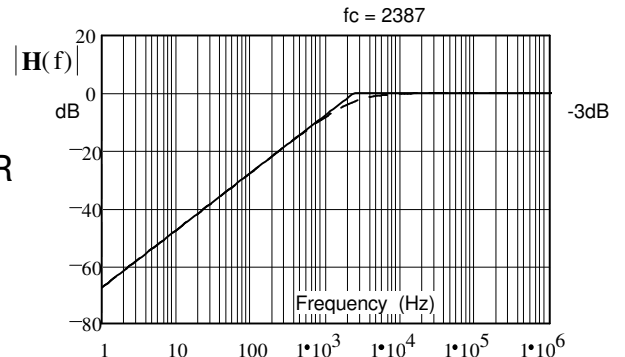
Answers

- 12dB, -12dB, 54dB, 86dB
- 10, 200, 0.005, 10^4

4.a)



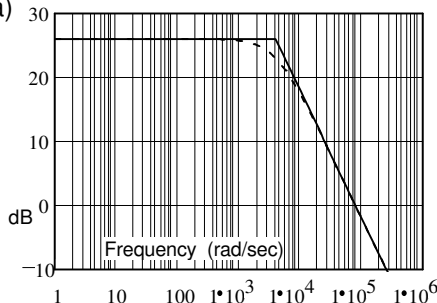
OR



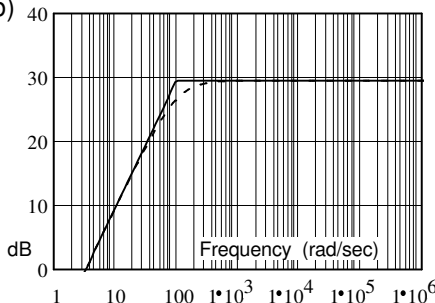
c) -3dB at 15000 rad/sec or 2387 Hz

d) -1dB at 30000 rad/sec or 4774 Hz

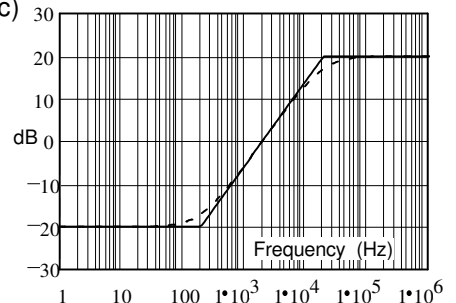
5. a)



b)



c)



4. high-pass
- 5.a) low-pass
- b) high-pass
- c) high-pass