

GEORGIA INSTITUTE OF TECHNOLOGY  
School of Electrical and Computer Engineering

ECE 2040  
**Circuit Analysis**

Quiz #4

Wednesday, November 29, 2000

Name: \_\_\_\_\_

**GENERAL INSTRUCTIONS**

1. This is a *closed book, closed notes* exam. You may use a calculator if you choose.
2. Please do all of your work on the exam itself. You may use the backs of the pages, if necessary.
3. Please be as neat and well organized as possible.
4. Clearly indicate your answers.

<i>Problem</i>	<i>Max</i>	<i>Score</i>
1	25	
2	25	
3	25	
4	25	
Total	100	

**Problem Q4.1:** A circuit with input source waveform  $x_{in}(t)$  and output  $y_{out}(t)$  has the system function

$$H(s) = \frac{s}{(s+2)^2 + 100}.$$

Determine  $y_{out}(t)$ , if

$$x_{in}(t) = 3 \cos(10t).$$

**Problem Q4.2:**

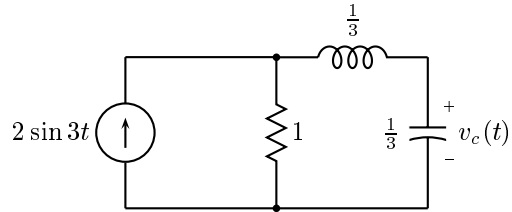


Figure 1: Circuit for Problem Q4.2.

- (a) Find the system function of the circuit in Figure 1.
- (b) Find  $v_c(t)$  for all  $t$ .

**Problem Q4.3:** A circuit has the pole-zero plot shown in Figure 2.

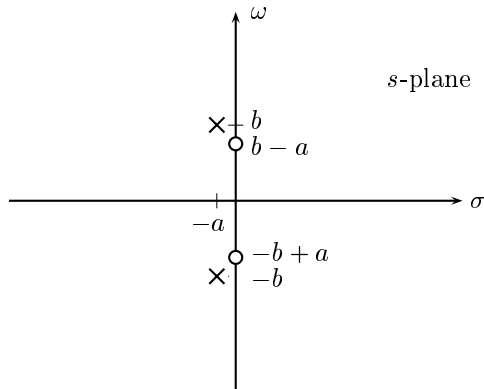
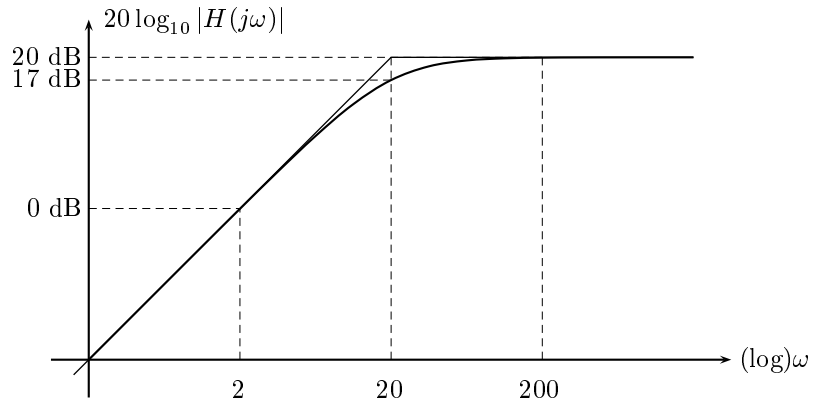


Figure 2: A pole-zero plot for Problem Q4.3.

- (a) Graph the magnitude response of the filter. Indicate key frequencies on your plot.
- (b) Determine the phase at the following frequencies:
- (i)  $\omega = 0$ .
  - (ii)  $\omega = \infty$ .
  - (iii)  $\omega = b - a - \epsilon$ ,  $\epsilon =$  a very small number.
  - (iv)  $\omega = b - a + \epsilon$ .
  - (v)  $\omega = a + b$ .

**Problem Q4.4:** A stable circuit (i.e. one with all of its poles in the left half of the  $s$ -plane) has the Bode magnitude plot shown below.



- Determine the locations of all of the poles and zeros of the circuit.
- Determine the system function of the circuit,  $H(s)$ .
- Draw the Bode phase plot (asymptotes only). Clearly label your plot.