ECE 301 B6 48/50

11/15/06

12-35) Construct the straight-line Bode plot of the gain of the following transfer function. Is this a low-pass, high-pass, bandpass, or bandstop function? Estimate the cutoff frequency and passband gain.

$$T(s) = \frac{25s(s+20)}{(s+5)(s+100)} = \frac{\cancel{500}\, s\left(\frac{s}{20}+1\right)}{\cancel{500}\left(\frac{s}{5}+1\right)\left(\frac{s}{100}+1\right)}$$

$$T(j\omega) = \frac{(j\omega)\left(\frac{j\omega}{20}+1\right)}{\left(\frac{j\omega}{5}+1\right)\left(\frac{j\omega}{100}+1\right)}$$

Breakpoints (starting from left):
- 1 zero @ $\omega = 0$
- 1 pole @ $\omega = 5$
- 1 zero @ $\omega = 20$
- 1 pole @ $\omega = 100$

High Pass
$\omega_c = 100$ rad/s
Passband Gain = 28 dB

* Bode plot attached

12-36) Repeat 12-35 for $T(s) = \frac{10(s+5)(s+20)}{(s+1)(s+100)} = \frac{1000\left(\frac{s}{5}+1\right)\left(\frac{s}{20}+1\right)}{100(s+1)\left(\frac{s}{100}+1\right)}$

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$$T(j\omega) = \frac{10\left(\frac{j\omega}{5}+1\right)\left(\frac{j\omega}{20}+1\right)}{(j\omega+1)\left(\frac{j\omega}{100}+1\right)}$$

$T(.01) = 9.92 \approx 20$dB

Breakpoints (starting from left):
- 1 pole @ $\omega = 1$
- 1 zero @ $\omega = 5$
- 1 zero @ $\omega = 20$
- 1 pole @ $\omega = 100$

Bandstop
$\omega_c = 1, 100$ rad/s
Passband Gain = 20dB

* Bode plot attached

12-37) Repeat 12-35 for $T(s) = \frac{8s^2}{(0.4s+1)^2} \Rightarrow T(j\omega) = \frac{8(j\omega)^2}{\left(\frac{j\omega 4}{10}+1\right)^2}$

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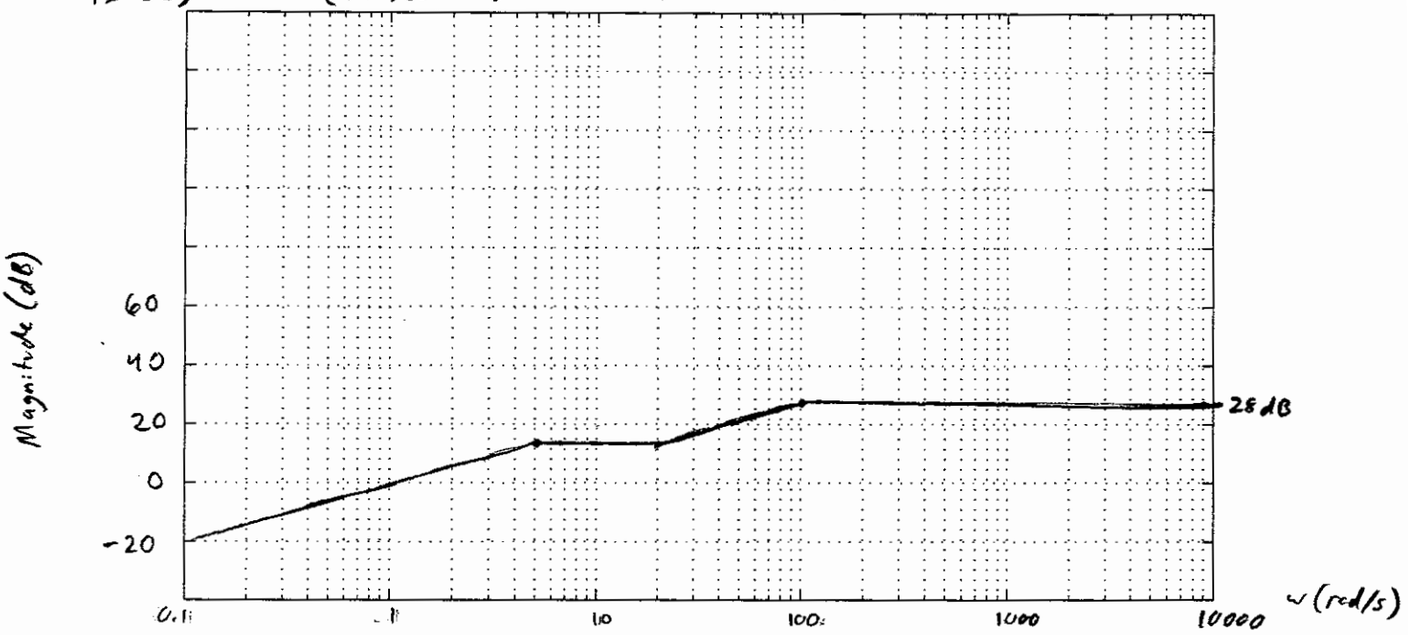
$T(.01) = .000797 \approx -60$ dB

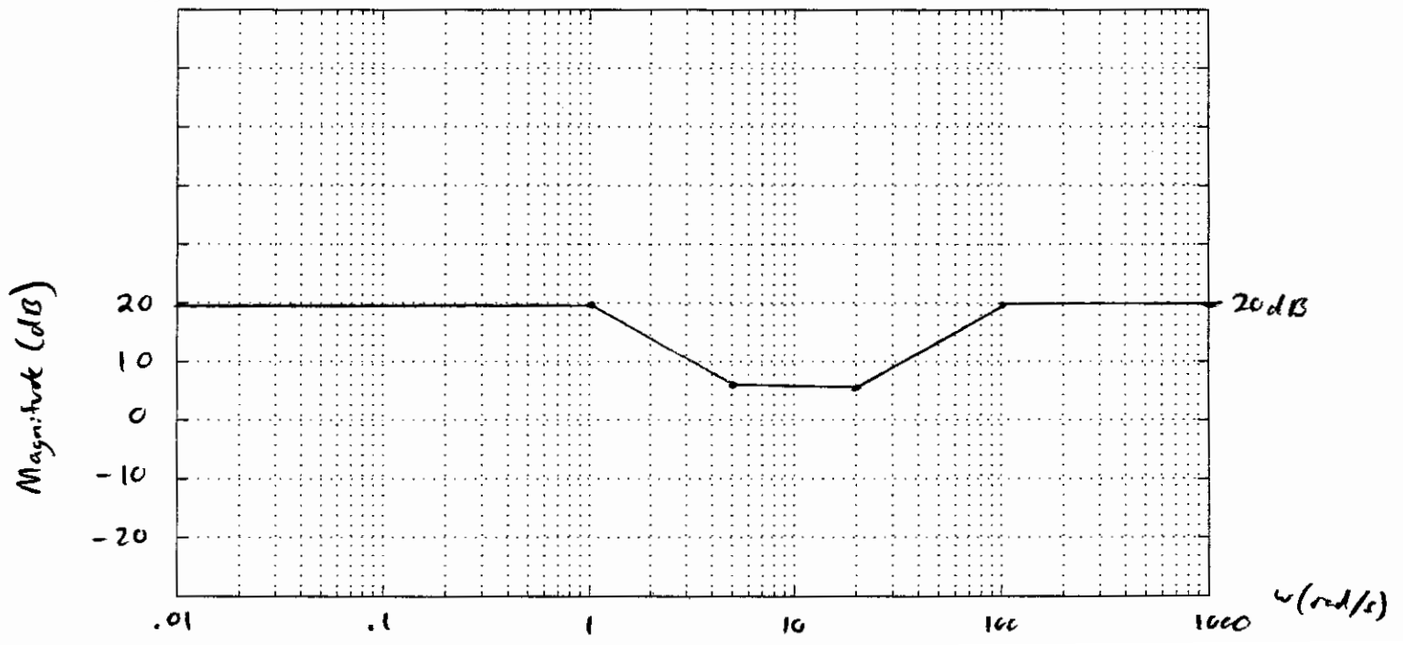
Breakpoints:
- 2 zeros @ $\omega = 0$
- 2 poles @ $\omega = 5/2$

High Pass
$\omega_c = 5/2$ rad/s
Passband Gain = 34dB

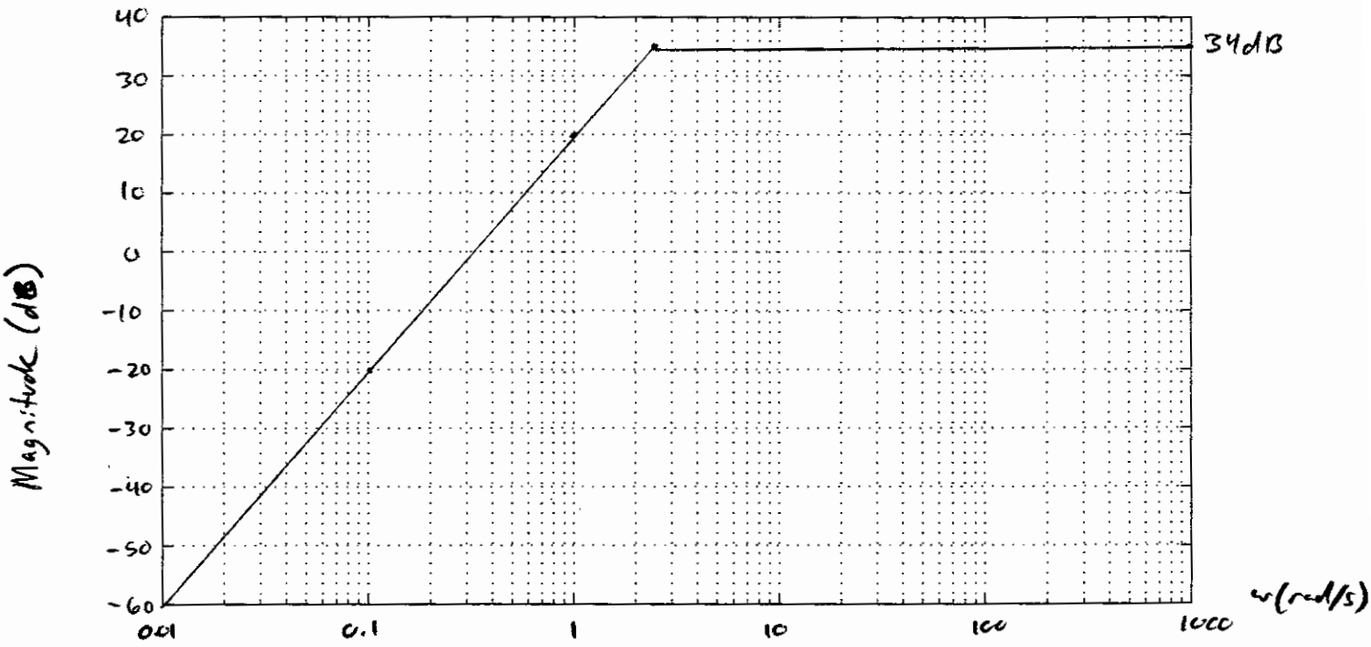
12-35) $T(s) = \frac{25s(s+20)}{(s+5)(s+100)}$ Bode plot of gain



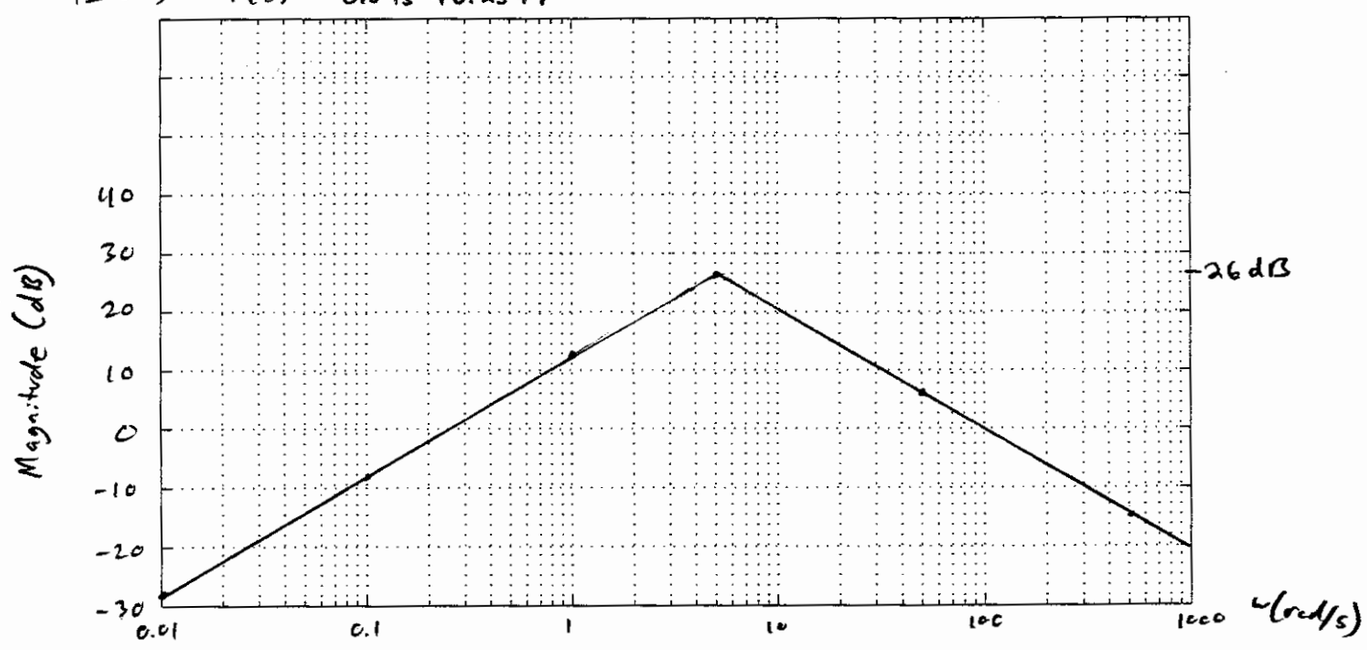
12-36) $T(s) = \frac{10(s+5)(s+20)}{(s+1)(s+100)}$



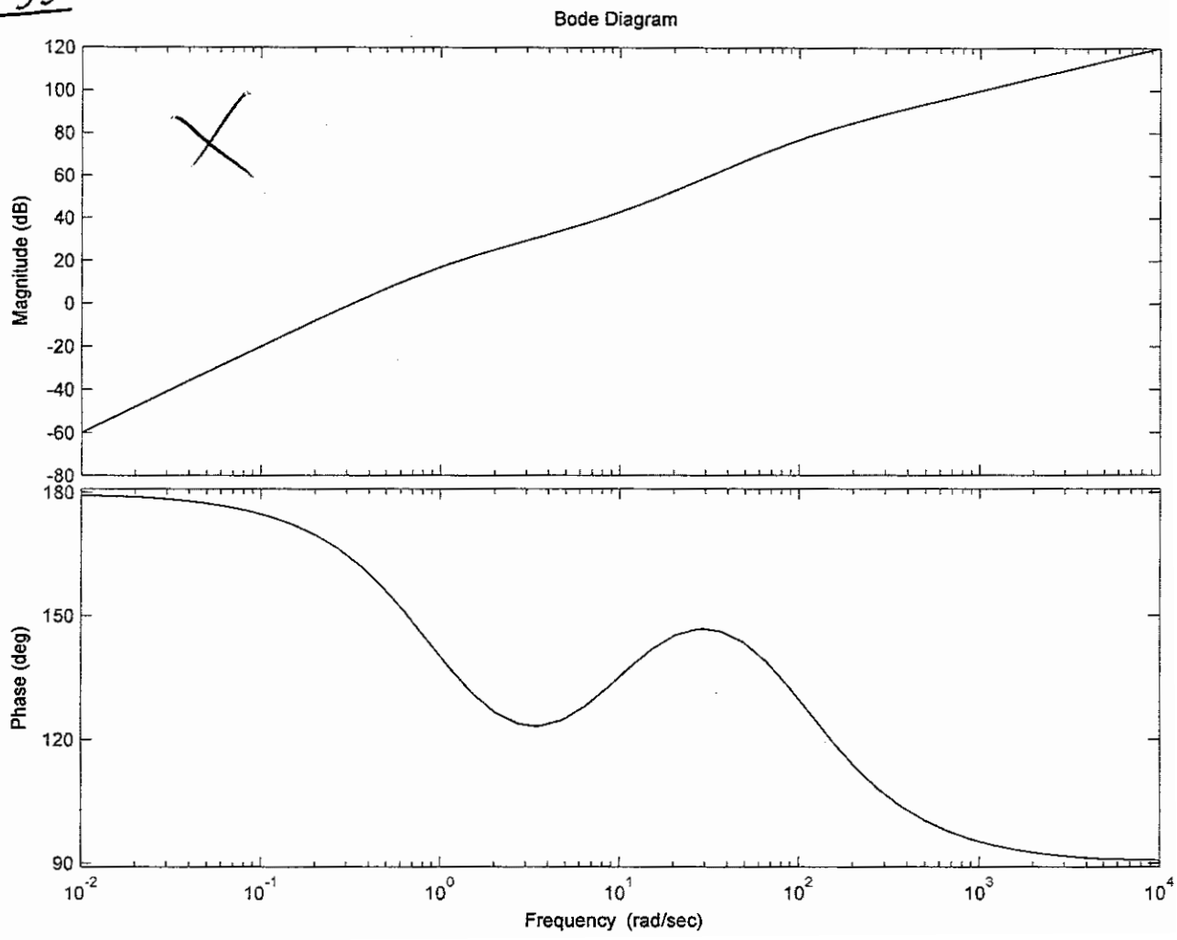
12-37) $T(s) = \frac{8s^2}{(0.4s+1)^2}$



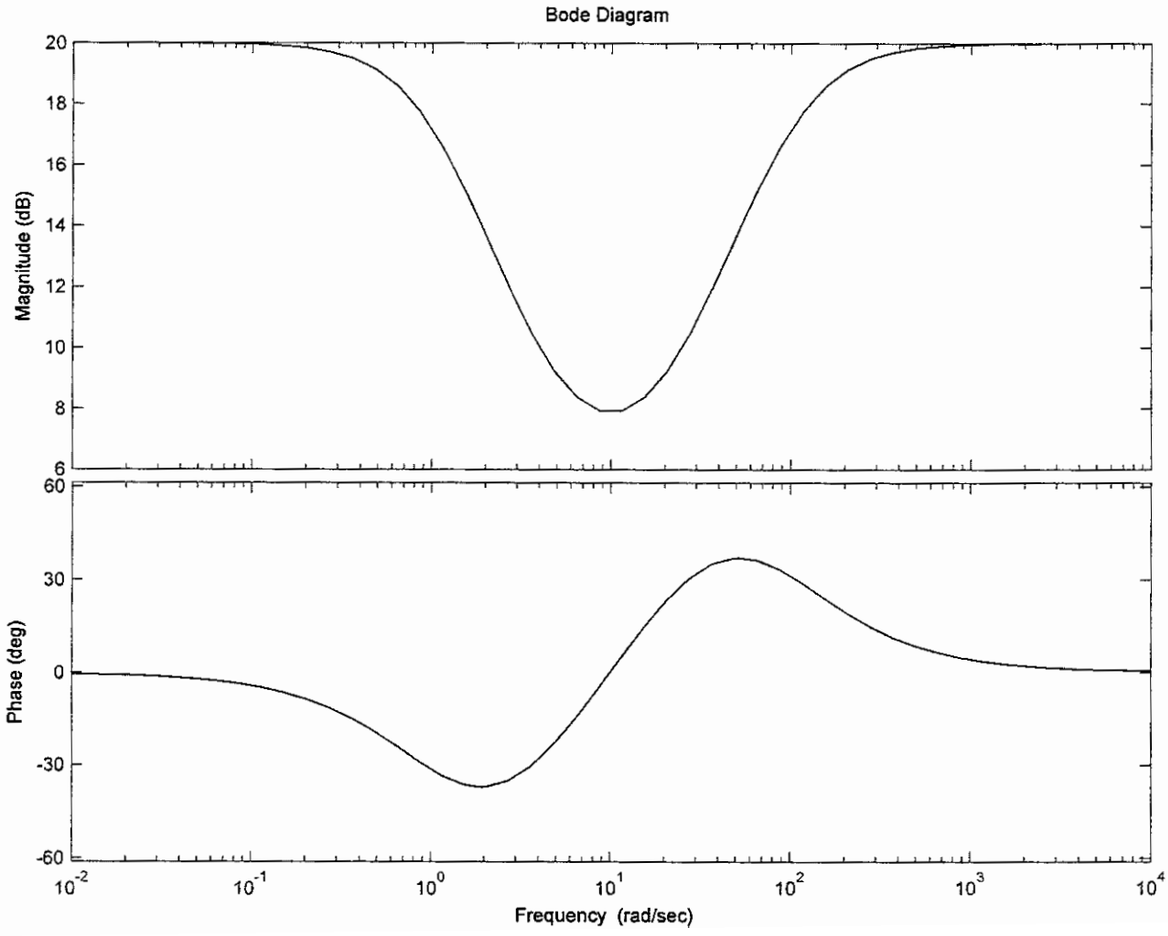
12-38) $T(s) = \frac{4s}{0.04s^2+0.2s+1}$



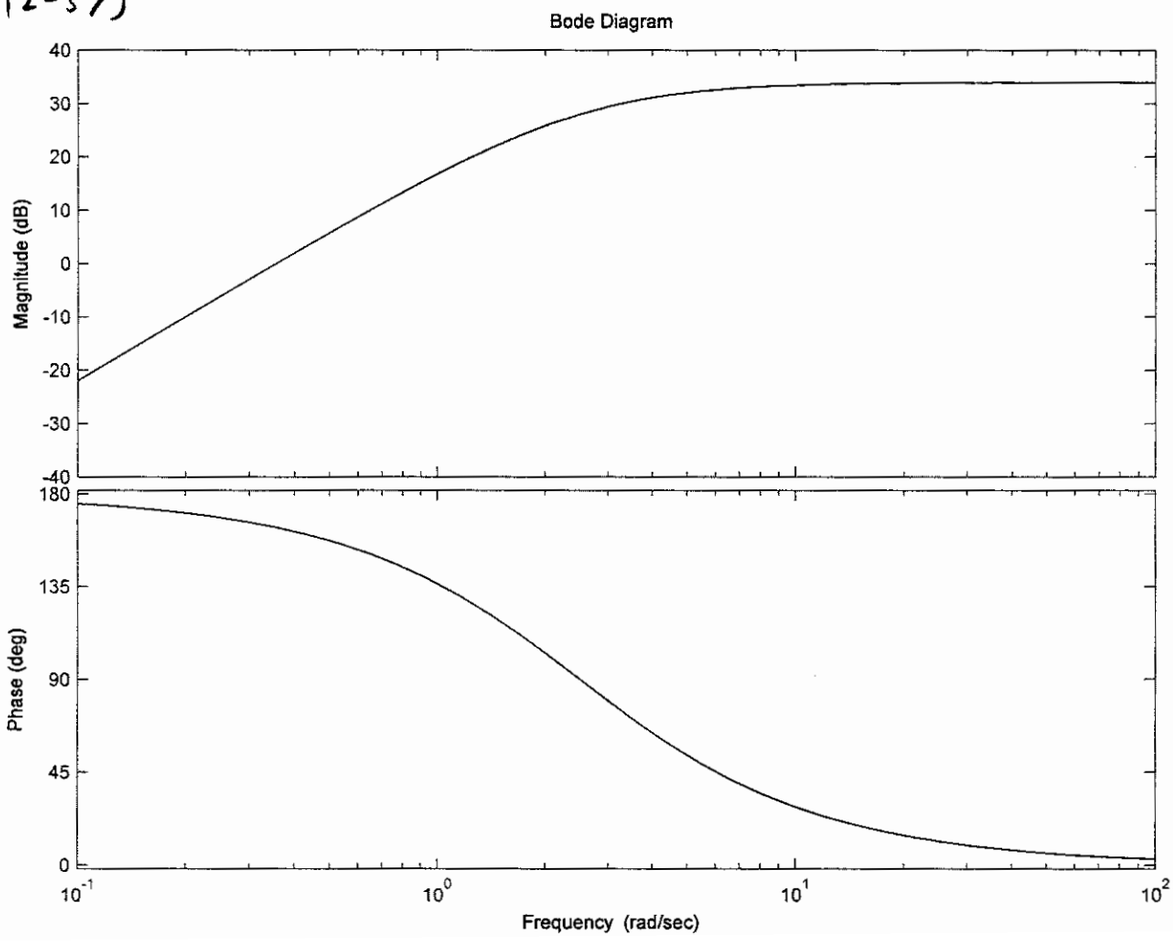
12-35


Bode Diagram
Magnitude (dB)
120
100
80
60
40
20
0
-20
-40
-60
-80
Phase (deg)
180
150
120
90
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Frequency (rad/sec)

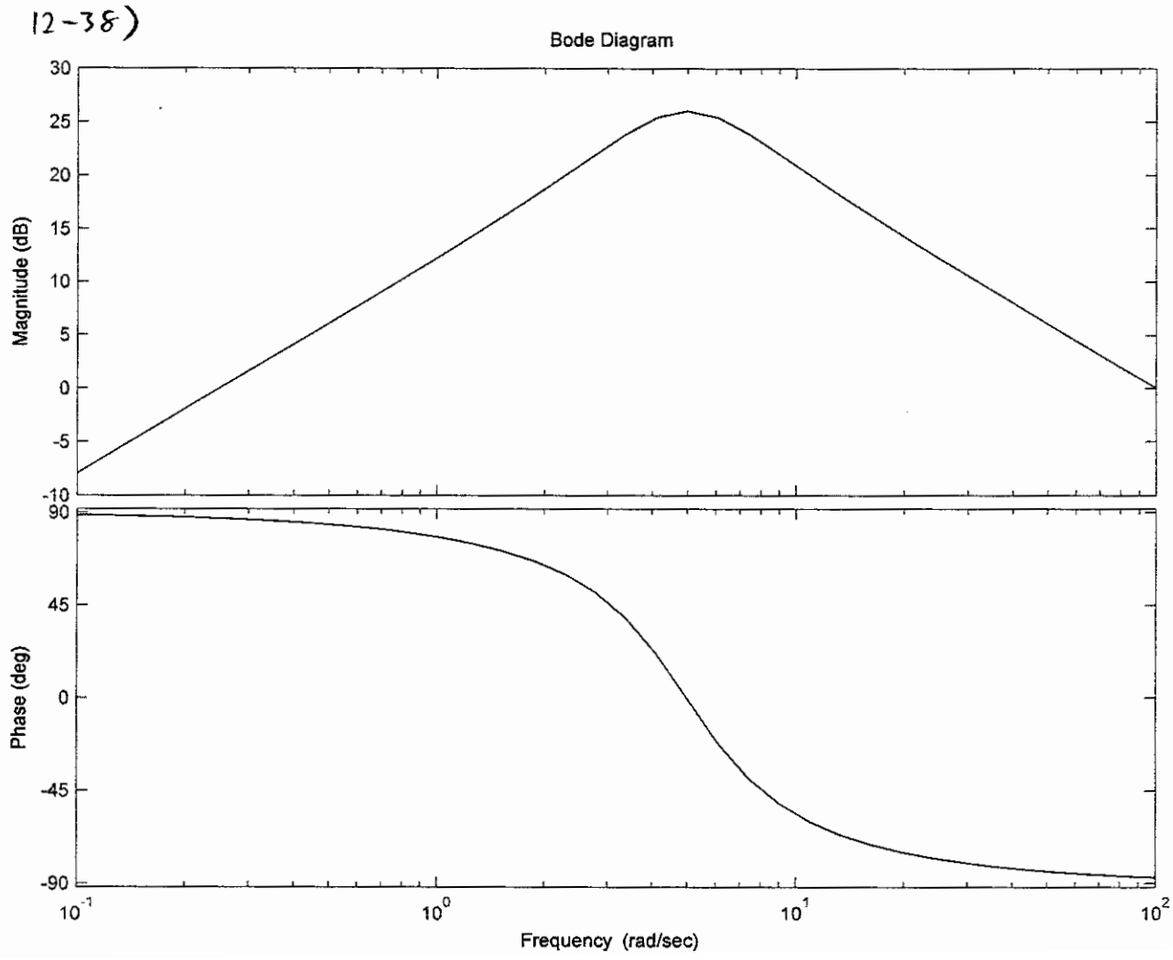
12-36)


Bode Diagram
Magnitude (dB)
20
18
16
14
12
10
8
6
Phase (deg)
60
30
0
-30
-60
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Frequency (rad/sec)

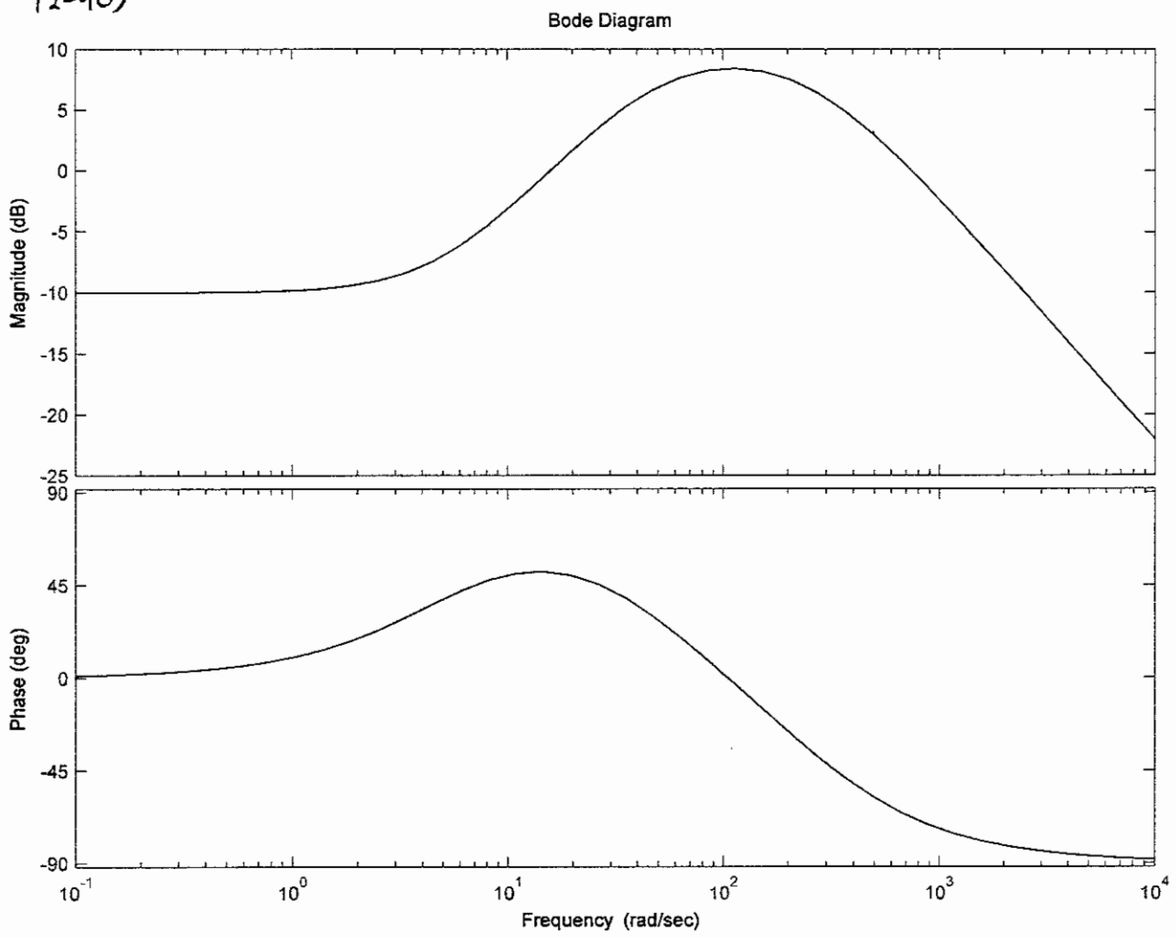
12-37)


Bode Diagram
Magnitude (dB)
40
30
20
10
0
-10
-20
-30
-40
Phase (deg)
180
135
90
45
0
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/sec)

12-38)


Bode Diagram
Magnitude (dB)
30
25
20
15
10
5
0
-5
-10
Phase (deg)
90
45
0
-45
-90
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/sec)

12-40)


Bode Diagram
Magnitude (dB)
10
5
0
-5
-10
-15
-20
-25
Phase (deg)
90
45
0
-45
-90
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
Frequency (rad/sec)