Problem 1.
For \( L = 2 \, \text{H}, \, C = 500 \, \text{nF}, \, \text{and} \, R = 1 \, \text{k}\Omega \) determine the sinusoidal steady-state output current \( i_2(t) \) for \( i_1(t) = 5\cos 1000t \). Repeat for \( i_1(t) = 10\sin 500t \).

Problem 2.
The step response of a circuit is \( g(t) = [2e^{-at} - 1]u(t) \) where \( a > 0 \) is a real number.
(a) Find the circuit transfer function. Is the circuit stable?
(b) For a certain input \( x(t) \), the output is \( y(t) = [2e^{-at}u(t) \). Find one possible input \( x(t) \).

Problem 3.
A ladder network has a voltage gain of
\[
H(\omega) = \frac{10}{(1 + j\omega)(10 + j\omega)}
\]
Sketch the Bode plots for the gain.

Problem 4.
Sketch the Bode plots for
\[
H(\omega) = \frac{10 + j\omega}{j\omega(2 + j\omega)}
\]

Problem 5.
Sketch the Bode plots for
\[
T(s) = \frac{s + 1}{s(s + 10)}
\]

Problem 6.
Construct the Bode plots for
\[
G(s) = \frac{s + 1}{s^2(s + 10)}, \quad s = j\omega
\]

Problem 7.
Sketch Bode magnitude and phase plots for
\[
H(s) = \frac{40(s+1)}{[(s+2)(s+10)]}; \, s = j\omega
\]

Problem 8.
Sketch the Bode plots for
\[
G(s) = \frac{s}{(s + 2)^2(s + 1)}, \quad s = j\omega
\]

Problem 9.
Sketch the asymptotic Bode plots of the magnitude and phase for
\[ H(s) = \frac{100s}{(s + 10)(s + 20)(s + 40)}, \quad s = j\omega \]

**Problem 10.**
Find the transfer function \( H(\omega) \) with the Bode magnitude plot shown below:

![Bode magnitude plot for Problem 10](image)

**Problem 11.**
The Bode magnitude plot of \( H(\omega) \) is shown below. Find \( H(\omega) \).

![Bode magnitude plot for Problem 11](image)

**Problem 12.**
The magnitude plot in the figure below represents the transfer function of a preamplifier. Find \( H(s) \).

![Bode magnitude plot for Problem 12](image)