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
$$H(s) = \frac{40(s + 1)}{(s + 2)(s + 10)}; \quad s = j\omega$$

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

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

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