THESE ARE ONLY A FEW QUESTIONS. I WILL GIVE MORE ON TUESDAY, APRIL 27

Problem I

In figure 1,

Let $G_1(j\omega) = 0$,

Let $G_2(j\omega) = 1$ if $1 \leq |\omega| \leq 2$,

Let $G_3(j\omega) = 0$,

Let $g_4(t) = e^{-2t}U(t)$

Question 1 What is the impulse response, $G_4$?

Question 2 What is the frequency transfer function from $x$ to $y$?
Problem 2

a) The Laplace transform of a causal filter response is

\[ H_f(s) = \frac{s}{(s + 2)^2 + 4} \]

Compute the impulse response, \( h_f(t) \).

b) Do the same for

\[ H_f(s) = \frac{1}{(s + 2)^2 + 4} \]

Problem 3

Let \( G_1(s) = 1 \),
Let \( g_2(t) = e^{-t}U(t) \),
Let \( G_3(s) = 0 \),
Let \( G_4(s) = s \)

Question 1 What is the System Function from \( x \) to \( y \)?

Question 2 Write the differential equation with this System function.

Problem 4

Let \( G_1(s) = \frac{1}{s-2} \),
Let \( g_2(t) = e^{-t}U(t) \),
Let $G_3(s) = s + 1$.

Let $G_4(s) = K$

Question 1 For what values of $K$ is the System Function from $x$ to $y$ stable?

Question 2 Answer the similar question when $G_1(s) = \frac{-1}{s-2}$

Problem 5

A system has input, $x(t)$ and output $y(t)$ related by

$$\frac{d^2}{dt^2}y(t) + 4\frac{d}{dt}y(t) + 4y(t) = \frac{d}{dt}x(t)$$

Question 1 Find the impulse response of this system

Question 2 Find the response when $x(t) = e^{-t}U(t)$