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EE 229 **Autumn 2023**

Quiz 2

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Be sure to write your name **and** *roll number above. Write only your* **final** *answers in the space provided after each question. A seperate sheet is provided to you for rough work.*

1. [10 marks] The discrete-time signal $x[n]$ is periodic with period N, and

$$x[n] \xrightarrow{\text{DTFS}} a_k.$$

Express the DTFS coefficients of $x[n]\cos(\frac{6\pi n}{N})$ in terms of a_k.

Your answer:

$(a_k * b_k)$ where $b_k = \text{DTFS}\left(\cos\left(\frac{6\pi n}{N}\right)\right)$.

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2. [10 marks] Consider three continuous time systems $\mathcal{S}_1$, $\mathcal{S}_2$, and $\mathcal{S}_3$. The responses of these systems to the input signal e^{j5t} is given below.

$$e^{j5t} \xrightarrow{\mathcal{S}_1} te^{j5t}$$
$$e^{j5t} \xrightarrow{\mathcal{S}_2} \sin\left(5t + \frac{\pi}{4}\right)$$
$$e^{j5t} \xrightarrow{\mathcal{S}_3} \cos(5t)$$

Given the above information, which of the systems $\mathcal{S}_1$, $\mathcal{S}_2$, and $\mathcal{S}_3$ are definitely **not** LTI?

Your answer:

S_1, S_2 and S_3

(all three are NOT LTI) ✓

3. [10 marks] Consider a causal continuous-time LTI system whose input $x(t)$ and output $y(t)$ are related by the following differential equation:

$$2\frac{d}{dt}y(t) + 3y(t) = x(t)$$

Obtain the output signal $y(t)$ corresponding to the input signal $\cos(t)$.

Your answer:

$$\frac{\int e^{3t/2}\cos(t)\,dt}{2e^{3t/2}}$$

, So that $x(0) \to y(0)$.

(LTI)

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