Signals & Systems

MID EXAM - SPRING 2021: Sec A Batch - 2

12, May, 2021

Instructions

1. Answer all questions. Include your roll no. and name on all pages. Please number the pages in your answer scripts
2. Total time for the exam: 90 min : −80min for descriptive and 10min for MCQs.
3. After the MCQ there will be an extra 10 min buffer time to scan and upload your scans.
4. Maximum Marks: 20.
5. Marks for each question is indicated in a parenthesis against each question
6. **This exam is closed book and closed internet**. You will need a computer and a few A4 sheets.
7. Please note that when you take the exam you are implicitly agreeing to not use any other means of support
8. Combine the scans of solutions and any sketches into a single pdf
9. Naming convention for the final zip: SS_MID_Rollno; Roll no is your full roll number.
10. For uploading the pdf, a google form for file upload will be shared during the exam. Only files uploaded here will be evaluated.

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1 Signal Transformations:Discrete Case

Given the following discrete signal (3)

$$x[n] = \{\underset{\uparrow}{2},\ 1,\ -3,\ 1,\ -5, 1\}$$

Plot the following:

- $x[n+3]$
- $x[1-n]$
- $x[n-2]$
- $x[1+2n]$

2 Signal Transformations: Continuous Case

Given the following signals (3)

$$\begin{aligned} x(t) &= exp(t) \quad -2 \leq t \leq 0 \\ y(t) &= 1 - exp(t) \quad -3 \leq t \leq 0 \end{aligned}$$

Sketch the signals $x(t)$, $y(t)$ and the product $x(t+1)y(t-1)$

3 Linear Convolution

Given the signal and the system impulse response (6)

$$\begin{aligned} x_2[n] &= \{3, 2, \underset{\uparrow}{1}, \ 2, \ -1, \ 2, \ 3, \} \\ h[n] &= \{\underset{\uparrow}{2}, \ -1, \ 2, 1, \ -2\} \end{aligned}$$

Determine the following convolution sums

- $y_1[n] = x_2[n] * h[n-1]$
- $y_2[n] = x_2[1-n] * h[n]$

Plot the input and the output signals.

4 LTI Systems

Given the systems (3)

1. $y[n] = ay[n-2] - bx[1-n]$
2. $y[n] = 0.5y[n-1] - x[n+2]$
3. $y[n] = x[-2n]$

Determine if each of the above system is time varying or not?