Indian Institute of Information Technology Sri City, Chittoor

Subject: Signals and Systems
Date: 25th May 2022
Marks: 25

Exam: Mid-sem
Duration: 1h 30 Mins

Instructions:

1. Answer all the questions
2. It's a closed book exam, no notes and formula sheets are allowed.
3. Electronic gadgets are not allowed, students may carry non-programable calculators
4. During the exam, exchange of calculator or any other writing material is strictly prohibited.
5. Answer all parts of the question at one place.
6. *You need to return the question paper along with the answer sheet.*

Q1. Justify in details whether the following systems: [10]

a) $y(t) = \cos\big(2\pi x(t+1)\big) + x(t)$ is linear/non-linear.

b) $y[n] = e^{-n}x[n] + 1$ is time-variance/time invariance

c) $x[n] = \{\frac{1}{\uparrow}, 1, 1\}$, $y[n] = \{\frac{1}{\uparrow}, \frac{1}{2}, 2\}$ is Causal/non-Causal

d) $y[n] = u[n]u[-n]$ is energy/power signal

e) $y[n] = x[n]\sum_{k=-1}^{1}\delta[n-2k]$ is memory/memoryless

Q2. Determine whether the following signals is periodic or not [Explain in details] [4]

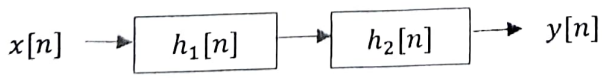
a) $x[n] = \cos\left(\frac{\pi n}{6}\right) + \sin\left(\frac{\pi n}{8}\right) + 3$
b) $x(t) = (\sin(3t+1))u(t)$

Q3. The step response $s[n]$ of a discrete-time LTI system is given by [3]

$$s[n] = \beta^n u[n],\ 0 < \beta < 1$$

Evaluate the impulse response $h(n)$ of the system.

Q4. The cascade interconnection of a Causal LTI system is shown below: [3 + 3 +2]



The impulse response of the second system is $h_2[n] = u[n] - u[n-2]$

a) Evaluate the $h_1[n]$ if the overall impulse response of the cascade system is $h[n] = \{\frac{3}{\uparrow}, 2, 1, -1\}$
b) Evaluate the $h_1[n]$ if the overall impulse response of the cascade system $h[n] = \{\frac{1}{\uparrow}\}$
c) Determine whether the cascade system is invertible if overall impulse response of the cascade system $h[n] = \{\frac{1}{\uparrow}, -1, 0\}$. Assume inverse system is also casual.