


VIT

Vellore Institute of Technology

Final Assessment Test – November 2024

Course: BEEE204L - Signals and Systems

Class NBR(s): 1255 / 1256

Time: Three Hours

Slot: F1+TF1

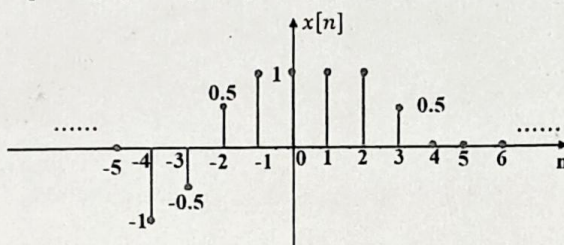
Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

 Answer ALL Questions

(10 X 10 = 100 Marks)

1. i) Determine whether the signal $x[n] = \sin\left(\frac{6\pi}{7}n + 1\right)$ is periodic. If the signal is periodic, determine its fundamental period.
- ii) For the discrete-time signal given below sketch the signal.
- $$y[n] = x[n-2]\delta[n-2] + x[n-3]\delta[n-3] + x[n+2]u[-n]$$



2. Determine which of the properties (Memoryless, Time-invariant, Linear, Causal, and Stable) hold and which do not hold for each of the system. Justify your answers. In each problem, $y(t)$ denotes the system output and $x(t)$ is the system input.

i) $y(t) = [\cos(3t)]x(t)$

ii) $y(t) = \frac{dx(t)}{dt}$

3. i) Determine whether the following system is invertible or not. If it is invertible system find its value.

$$y[n] = x[n]x[n-1]$$

- ii) Determine whether the given system is causal or stable

$$h[n] = \left(\frac{2}{5}\right)^n u[n]$$

4. Compute and plot the convolution $y[n] = x[n] * h[n]$, where

$$x[n] = \left(-\frac{1}{2}\right)^n u[n-4]$$

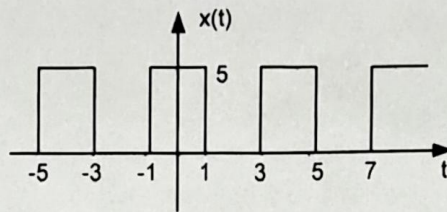
$$h[n] = (4)^n u[2-n]$$

5. Find the convolution of the following signals.

$$x(t) = e^{-at}u(t)$$

$$h(t) = u(t+2)$$

6. Determine the trigonometric Fourier series representation of the following signal.



7. Consider a causal and stable LTI system S whose input $x[n]$ and output $y[n]$ are related through the second order differential equation.

$$y[n] - \frac{1}{6}y[n-1] - \frac{1}{6}y[n-2] = x[n]$$

- Determine the frequency response $H(e^{j\omega})$ for the system S .
- Determine the impulse response $h[n]$ for the system S .

8. What is Aliasing effect? Explain with figures. How to avoid aliasing effect in the sampling process.

- 9.a) Determine the Laplace Transform and associated region of convergence for the following functions of time.

i) $x(t) = e^{-2t}u(t) + e^{-3t}u(t)$

ii) $x(t) = te^{-2|t|}$

OR

- 9.b) Determine the system function for causal LTI system with difference equation.

$$y[n] - \frac{1}{2}y[n-1] + \frac{1}{4}y[n-2] = x[n]$$

Using z- transforms, if $x[n] = \left(\frac{1}{2}\right)^n u[n]$

- 10.a) Determine the Fourier Transform of the Following periodic signal.

i) $x(t) = \sin\left(2\pi t + \frac{\pi}{4}\right)$

ii) $x(t) = 1 + \cos\left(6\pi t + \frac{\pi}{8}\right)$

OR

- 10.b) Find the Inverse discrete Fourier transform of the signal.

$$X(e^{j\Omega}) = \frac{3 - \frac{5}{4}e^{-j\Omega}}{\frac{1}{8}e^{-j2\Omega} - \frac{3}{4}e^{-j\Omega} + 1}$$

⇔⇔⇔ I/L/TX ⇔⇔⇔