C/L/TY

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Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: BEVD203L - Signal Processing

Class NBR(s): 2584 / 2588 Slot: G1+TG1

Time: Three Hours 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

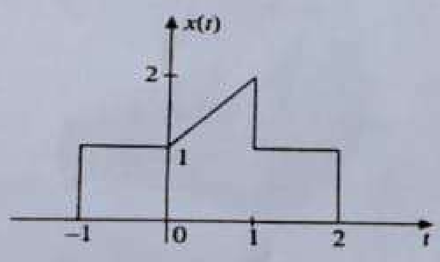
COs	CO Statements
CO1	Understand the fundamentals of signal classification and the concept of sampling theorem.
CO2	Understand different systems and concepts convolution and correlation
CO3	Apply the Fourier concepts to DT signals and Z transform to analyze the DT systems
CO4	Comprehend the various analog filter design techniques and be able to design digital filters
CO5	Realize digital filters using various system interconnections
CO6	Understand the types and architectures of digital signal processors

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

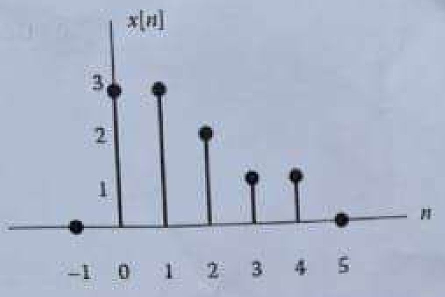
1. a) For the given signal $x(t)$, [6] CO1 BL2

Find $(i) x(-t+2)$, $(ii)\ x(2t+2)$, $(iii)\ x\left(\frac{3}{5}t\right)$



b) For the given signal x[n], sketch the following;

$(i)\ x[-n], (ii)\ x[n+2]$ [4]



2. a) Examine whether the given signals are periodic or not, if periodic find the fundamental period **[5]** CO1 BL3

$(i)\ x(t) = e^{j4\pi t}$ $(ii)\ x(t) = cos2t + sin\sqrt{3t}$

b) Find the response of the system with input $x[n]$ and impulse response $h[n]$ **[5]**

$$x[n] = 2\delta(n+1) - \delta(n) + \delta(n-1) + 3\delta(n-2),$$
$$h[n] = 3\delta(n-1) + 4\delta(n-2) + 2(n-3)$$

3. Determine whether the system $y(t) = x(t+10) + x^2(t)$ is static / dynamic, linear / Non-linear, causal / non-causal, stable / un-stable, time variant / invariant. CO2 BL3

4. For the following system function, identify the possible ROCs, CO2 BL3

$$H(z) = \frac{z}{(z-\frac{1}{4})(z+\frac{1}{4})(z-\frac{1}{2})},$$

Also determine the causality, stability and impulse response of the system for all possible ROCs.

5. The first five points of the 8-point DFT of a real valued sequence $x[n]$ are; CO3 BL3

$$X[k] = \{12, 1 - j2.414,\ 0,\ 1 - j0.414, 0\}$$

Find the remaining three points based on DFT properties and also find the sequence $x[n]$ using DIT-FFT or DIF-FFT algorithm (mention your choice clearly).

6. Design a low pass filter with the following specification, CO3 BL3

$$H_d(e^{j\omega}) = \begin{cases} e^{-j2\omega} & , \quad |\omega| \le \frac{\pi}{4} \\ 0 & , \quad \frac{\pi}{4} < |\omega| < \pi \end{cases}$$

Using rectangular window $w_R(n) = 1, 0 \le n \le 4$, find the frequency response $H[\omega]$ of the resulting FIR Filter.

7.(a)	Design a digital Butterworth filter satisfying the following constraints: $$0.707 \le \lvert H(e^{j\omega})\rvert \le 1 \quad for \quad 0 \le \omega \le \frac{\pi}{2}$$ $$\lvert H(e^{j\omega})\rvert \le 0.2 \quad for \quad \frac{3\pi}{4} \le \omega \le \pi$$ With T=1sec using the bilinear transformation.	CO4	BL3
	OR		
7.(b)	Design an analog Butterworth low pass filter that has to meet the following specifications; (i) Passband ripple ≤1.5 dB and passband edge frequency 1300 Hz. (ii) Stopband attenuation ≥ 35 dB and Stopband edge frequency 6000 Hz.	CO4	BL3
8.	Design a Chebyshev analog low pass filter that has -3 dB cutoff frequency of 100 rad/sec and a stop band attenuation of 25 dB or greater for all radian frequencies past 250 rad/sec.	CO4	BL3
9.(a)	Draw the cascade form realization for the system described by, $$y[n] = -0.1\,y[n-1] + 0.72\,y[n-2] + 0.7x[n] - 0.252\,x[n-2]$$	CO5	BL3
	OR		
9.(b)	Determine the coefficients k_m of the lattice filter corresponding to FIR filter described by the system function, $$H(z) = 1 + 2z^{-1} + \frac{1}{3}z^{-2}$$ Also draw the second-order lattice structure.	CO5	BL3
10.	a) List out the differences between Von-Neumann, and Harvard architectures. [5] b) How does the finite word length effects influence the performance of FIR filters in DSP systems? [5]	CO6	BL3

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