CBCS SCHEME - Make-Up Exam

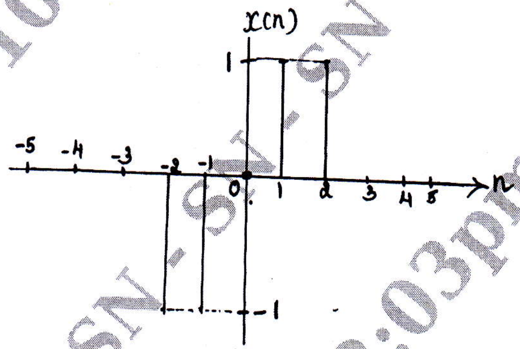
USN | | | | | | | | | | |

BEC502

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2025
Digital Signal Processing

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define signals and systems. Briefly explain any two classifications of signals.	6	L1	CO1
	b.	Determine whether the following signals are periodic or not? If periodic determine the fundamental period. i) $x(n) = \cos\frac{\pi n}{2} \cos\frac{\pi n}{4}$ ii) ii) $x(n) = \cos(100\pi n) + \sin(5\pi n)$	8	L2	CO1
	c.	Determine the even and odd components of figure Q1(c)  Fig Q1(c)	6	L2	CO1
		OR			
Q.2	a.	Define the following with an example causal system, memoryless system and linear system.	6	L1	CO1
	b.	Verify the following system are Linear, time in variant, causal stable $y(n) = ax(n)+b$	6	L2	CO1
	c.	Determine the response of the system if $x(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ $h(n) = \{1, \underset{\uparrow}{2}, 0, -1\}$.	8	L2	CO2
		Module – 2			
Q.3	a.	Analyze the given function to calculate the Z-transform and indicate ROC. $x(n) = \alpha^{\lvert n \rvert}$; $\lvert\alpha\rvert < 1$.	8	L3	CO2
	b.	Write a program to compute N-point DFT of a given sequence (without using built in function) and to plot the magnitude and phase spectrum.	8	L3	CO3
	c.	Find the DFT of the sequence $x(n) = \cos\left(\frac{n\pi}{4}\right)$.	4	L2	CO3

		OR			
Q.4	**a.**	Find the Z-transform of the signal $x(n) = n\left(\frac{1}{3}\right)^n u(n)$	**8**	**L2**	**CO2**
	b.	Write a program to compute linear and circular convolution of any two sequences using DFT and IDFT.	**8**	**L3**	**CO3**
	c.	Compute the IDFT of sequence $x(k) = \{10, -2+2j, -2, -2-2j\}$	**4**	**L3**	**CO3**
		Module – 3			
Q.5	**a.**	State and prove the multiplication property of DFT.	**10**	**L2**	**CO3**
	b.	Let $h(n) = \{1, 1, 1\}$ and $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$. Obtain the output y(n) using overlap save method.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	State and prove the property of Parseval's theorem.	**10**	**L2**	**CO3**
	b.	Compute the 8-point DFT of the sequence {1, 2, 3, 4, 4, 3, 2, 1} using DIT FFT.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	For the given system function. Draw the direct form and cascade form. $H(z) = 1 + 5/2z^{-1} + 2z^{-2} + 2z^{-3}$	**10**	**L2**	**CO4**
	b.	Design a high pass FIR filter using hamming window. Give $W_c = 1$ rad/sec and $M = 7$.	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	The linear phase FIR filter frequency response is $H[e^{jw}] = e^{-j3w}[2 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w]$. Find impulse response sequence of the filter.	**10**	**L3**	**CO4**
	b.	With the equations, sketch the spectrum of following windows. i) Rectangular ii) Bartlett iii) Hanning	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	From the given difference equation obtain the equation for H(z) and Also, realize it using Direct form – I and Direct form – II $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$.	**10**	**L2**	**CO5**
	b.	Explain the Analog filters translation using Low pass prototype transformation.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Write a program to Design and Implement i) IIR Butterworth low pass filter ii) IIR Butterworth high pass filter	**10**	**L3**	**CO5**
	b.	Design a digital Butterworth filter with the following specifications. $0.707 \le \lvert H(e^{jw}) \rvert \le 1$; $0 \le w \le 0.5\pi$ $\lvert H(e^{jw}) \rvert \le 0.2$; $0.75\pi \le w \le \pi$ Determine system function H(z) for a Butterworth filter using bilinear transformation.	**10**	**L3**	**CO5**